THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Where to Find the Western Gas Association's Exhibit, and the Custodian Thereof, at the World's Fair.

To the Fraternity: The exhibit of the Western Gas Association, at the World's Fair, St. Louis, is located in Section 33A, Liberal Arts Building, where Mr. Fred. R. Persons, who is in charge of the same, will always be on hand to receive visitors and to explain anything that requires explaining.

[OFFICIAL NOTICE.]

Thirty-Second Annual Meeting, American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW YORK CITY, Sept. 14, 1904.

General Announcement.—There will be an annual meeting of the American Gas Light Association held at Washington, D. C., October 19th to 21st, 1904. The meeting will be called to order by the President, Rollin Norris, of Philadelphia, Pa., at 10 A.M., on Wednesday, Oct. 19.

The meeting hall will be on the tenth floor of the New Willard Hotel. The headquarters will be at the New Willard Hotel, 14th and F streets, Washington, D. C.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The New Willard Hotel is conducted solely on the European plan, and the rates for rooms will be as follows: Rooms without bath, $2.50 per day and upwards; rooms with bath, $3.50 per day and upwards. Double rooms without bath, $4 per day and upwards; double rooms with bath, $5 per day and upwards.

As the meeting room is in the hotel, it is hoped that all will make their headquarters at this hotel. There are, however, other hotels in the vicinity.

The roll call will be made by means of the door card system. Each member upon entering the hall for the first time will, at the door, receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards. A blank form of application for membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the hands of the Secretary by October 10th at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at the meeting is as follows:

"Generation of Steam by Waste Heat from Water Gas Sets," by Donald McDonald, Louisville, Ky.

"Distributing Power Throughout a Gas Works by Means of Electricity Generated at a Central Point," by W. A. Baehr, St. Louis, Mo.

"Oxide Purification," by E. H. Earnshaw, Philadelphia, Pa.

"Methods of Charging for Gas," by F. W. Frueauff, Denver, Col.
"Consumers' Meters," by B. H. Spangenberg, Philadelphia, Pa.
"A Rapid Method for the Determination of Total Sulphur in Gas," by Mr. W. B. Calkins, St. Louis, Mo.

There will also be discussions on subjects connected with coal gas manufacture.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the year book containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given that if any of the speakers at this meeting desire to correct their remarks before they are printed, they will be given an opportunity before leaving Washington, but not after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the meeting, and all those who desire to correct their remarks must notify the Secretary at the close of the session at which such remarks are made, as all the reports will be turned in to the printer immediately after the adjournment of the meeting.

Special.—As Washington is a very interesting city, it has been decided to have no entertainment on Wednesday night—leaving the members free at that time. There will, however, be a banquet on Thursday evening, and a steamboat excursion to Mount Vernon on Friday with luncheon.

For the ladies there will be on Thursday a trip around Washington in automobiles, and the Mount Vernon trip on Friday.

There will probably be a theater party for the ladies on Thursday evening, as the banquet will be for the men exclusively.

The price of tickets, including a seat at the banquet and the trip to Mount Vernon for the purchaser, and an automobile trip, luncheon and theater ticket for one lady, will be $5. Extra tickets will be sold for ladies for the automobile trip, luncheon, theater and Mount Vernon trip.

A. E. Forstall, Secretary.

[Notice.]

Bureau of Information, Ohio Gas Light Association.

City of Lilcoln Gas Co.,
Lincoln, Ills., Oct. 10, 1904.

To the Fraternity: At the last meeting of the Ohio Gas Light Association a Bureau of Information was decided upon, the idea of which is to render assistance to members who may have questions coming up or difficultles arising respecting which they would like some help. This Bureau has been established and is now ready for business. A number of co-Editors have been appointed to whom the various questions will be referred. As this is the first Bureau of Information attempted by any Association, it is hoped that the members will take advantage of its opportunities. The co-Editors are as follows:

Distribution.—E. E. Eysenbach and M. E. Malone.
Accounts and Bookkeeping.—D. W. Low and Chas. Ritter.
New Business and Gas Appliances.—Frank D. Moses, Ralph Woodward and F. Cavanagh.
Chemistry —H. B. Harrop and Clarence Lomax.
Retort House.—Moses Coombs.
Natural Gas.—W. H. Hammon and Geo. W. Barnes.

All questions should be addressed to the Editor, at Lincoln, Ills.

Very truly yours, H. L. Olds.
Editor Information Bureau.

BRIEFLY TOLD.

The Washington Meeting of the American Gas Light Association.—There is little to be said regarding the preliminaries for the 33d meeting of the American Gas Light Association in Washington this week. The outlook for a satisfactory and recompensing convention is bright to the dazzling point, and President Norris may be sure of an attendance that will compensate himself and his aides for their well-directed planning. We are indebted to Mr. Charles H. Dickey, Chairman of the Committee on Entertainment for the Ladies, for the specific information as to such entertainment. Thursday morning an automobile trip has been arranged that will plainly show (weather permitting) the beautiful city of Washington at its best. The start will be made from headquarters at 10 A.M., and the termination will be at luncheon, which Mr. Dickey and his aides calculate will be served at 1 P.M. In the evening, while the males will be enjoying their banquet, the females will be assisting at a theater party. On Friday the ladies will be the invited guests of the Washington Gas Company, which has planned for their entertainment the always enjoyable and never old journey to Mount Vernon and its historic places and monuments.

Some Random Notes from the World's Fair.—No. VI.—World's Fair, St. Louis, Mo., Oct. 8th: Dear Journal: "Chicago Day" was a "howling success." Yes, "howling" is the word. Noise was dished out in such volumes that the "Pike" barkers were to all intents put out of business, though the "barkers" were doing their best. Mr. C. K. Wooster, of the Peoples Gas Light and Coke Company, headed the delegation representing the Chicago Athletic Club. The register of the Western Gas Association's booth here showed these names for the week: J. T. Lynn, Detroit; Francis Carroll, New Orleans; J. R. Wiredin, Salt Lake; B. O. Daubert, Milton, Pa.; G. L. Reichhelm, New York; E. C. Homer, Helena, Ark; J. A. Hohnberg, Lindabury, Kas.; M. H. Gaffney, Rockford, Ills.; E. M. Stephenson, Pittsburg, Kas.; C. W. Littlehales, Syracuse, N. Y.; C. F. Mason, Chicago; A. E. West, Bath Beach, N. Y.; R. M. Adams, Ozark, Ark; A. Jaquet, Paris, France; R. C. Pew, Toledo, O.; W. W. Brand, Toledo, O.; J. D. Browning, Marshall, Mo.; J. A. Heringa, Haarlem, Holland; W. G. Stanley, Carthage, Mo.; F. D. Moses, Trenton, N. J.; W. R. Hicks, Knoxville, Tenn.; W. G. Borgman, Detroit, Mich.; W. H. Flanigan, Cambridge, Mass.; W. E. Steinwedell, Cleveland, O.; B. F. Bullock, Norfolk, Va.; R. D. Apperson, Lynchburg, Va.; John Moncreith, Bloomington, Ills.; M. L. Mounts, Carlinville, Ills.; Sigmund Maury, New York; S. I. Warsawer, Brooklyn, N. Y.; H. B. Holman, Topeka, Kas.; Z. T. F. Runner, Freeport, Ills.; J. L. Harmon, President, Helena (Ark.) Gas Company. Hon. M. L. Mounts, of Carlinville, Ills., is one of the Commissioners of the Illinois State Building, World's Fair. Mrs. Mounts is the hostess of the building at the present time. The past week has been a busy one for them, as a big delegation has been here all the week. I wish we could gather a big delegation from the West for the American meeting, but so far the project does not keep up to the thought of its promoters. Mr. Francis Carroll, who was Superintendent of the New Orleans Gas Company from 1858 to 1900, as shown by the register, was a visitor here this week. His visit to the exhibit of the Western Gas Association in the Palace of Liberal Arts was perhaps one of the pleasantest calls he made at any exhibit. Mr. Carroll found the old oscillating engine installed here and in action. Mr. Carroll had many stories to tell of the engine. Some will do to repeat. A colored man was the engineer in charge of the engine long before and during war times. It became necessary to run the engine nights. The negro could not be prevailed upon to work around the engine at night because he declared there was a hoodoo or ghost that was always appearing at night. Mr. Carroll had a serious time to get a white man to take the job and keep it. During the war, when it was impossible to buy retorts or firebricks, Mr. Carroll used this engine to grind his old retorts and firebrick in order to get material to make new ones. He succeeded in making a good quality of the named materials that carried them along until peace and trade were restored. The old engine was used to pump water from the mains at stated times each day. Mr. Carroll says this engine was installed about 1834 or 1835, and was in constant use up to a few years ago. It was installed in the Western Gas Association exhibit in April, and is run every day by a concealed motor.—Fred. R. Persons."

Notes——

The gas exhibit at the World's Fair of the Western Gas Association has been awarded a Grand Prize by the Jury of Awards. Prizes of a similar nature were awarded to the Western Gas Construction Company, the Laclede Firebrick Manufacturing Company and the H. Mueller Manufacturing Company.

Mr. John R. Wilson, of Deadwood, has been appointed Receiver of the Lead-Deadwood Gas Light and Fuel Company, under bankruptcy proceedings instituted by certain Eastern creditors.

An "ad." inserted in the local papers by the Gas Company, of Montgomery county, Pa., at the instance of Superintendent Ganser, contains the following terse advice: "If your light is not satisfactory tell the Gas Company, not your neighbor."

Mr. Alanson P. Lathrop, Vice-President of the Detroit City Gas Company, has been appointed a member of the Detroit Board of Commerce.

The attention of advertisers is called to the small card inserted in this issue by order of Mr. W. P. Knowles, Superintendent of the Richmond (Va.) City Gas Works. He asks for bids on a gasholder up to retaining 2,000,000 cubic feet.

PROCEEDINGS, TWELFTH ANNUAL MEETING MICHIGAN GAS ASSOCIATION.

HELD IN JACKSON, MICH., SEPT. 21 AND 22, 1904.

FIRST DAY, MORNING SESSION.

The President, Mr. S. E. Wolff, of Jackson, called the convention to order at 10:30 A.M. Mr. H. W. Douglas, of Ann Arbor, Mich , occupied the Secretary's desk. On motion the roll call was postponed, and the reading of the minutes of the last meeting was ordered dispensed with. The

REPORT OF THE EXECUTIVE COMMITTEE

was as follows:

To the Members of the Michigan Gas Association: Your Executive Committee beg to report as follows. We recommend that the following be elected to membership:

Active.

Amsden, C. T., Dowagiac, Mich.
Baldwin, W. S., Detroit, Mich.
Benham, S., Albion, Mich.
Cochran, H. J., Maysville, Ky.
Cross, F. L., Detroit, Mich.
Engleberger, G. A., Adrian, Mich.
Kane, A., Adrian, Mich.
Lathrop, A. P., Detroit, Mich.
Larraway, B. R., Rochester, N. Y.
McPhail, J., Adrian, Mich.
Nevett, G. W., London, Ont.
Seitz, R., Hillsdale, Mich.
Soper, R. G., Pontiac, Mich.

Associate.

Cavaunagh, Thos. T., Salesman, Lindsay Light Co., Chicago, Ills.
Cressler, A. M., Fort Wayne, Ind.
Campi, Edward de.
Fricke, Chas. C., Chicago, Ills.
Jones, Ira A., Salesman, Pittsburg Lamp, Brass and Glass Co.
Lane, F. A., Supt. Const., Lloyd Const. Co., Detroit.
Lambourne, F. L., Salesman, Jas. Walker & Son.
Maitland, E. H., Fairmont Coal Co.
Patterson, S. S., Salesman, National Supply Co.
Powers, Wm. L., Salesman, Cleveland Gas & Electric Fixture Co.
Richardson, T. H., Sales Agent, Youghiogheny & Ohio Coal Co.
Slater, A. B., Fort Wayne, Ind.
Street, Henry, Chicago, Ills.
Wickham, E. S., Manager, Smokeless Fuel Co.

That after due notification has been given by the Secretary, W. F. Birchmore be dropped from associate membership for non-payment of dues.

We name the following to serve on the respective committees:

Nominations.—John Hellen, A. L. Zwissler and F. E. Sheriff.

Place of Next Meeting.—A. P. Ewing, B. C. Robinson and B. F. Gallagher.

Inasmuch as the income of the Association is hardly sufficient to meet the expense of properly printing the proceedings, we recommend that, due notice having been given at our last regular meeting, Article X. of the Constitution be amended by substituting the words "$3.00" for "$2.00" wherever they occur in such Article.

We recommend that at our next annual meeting the session be extended to three days. Respectfully submitted,

S. E. WOLFF,
B. C. COBB,
E. F. LLOYD,
H. W. DOUGLAS,
} Committee.

On motion the report was adopted. The

REPORTS OF THE SECRETARY AND TREASURER

were then read and adopted.

Vice-President E. F. Lloyd then assumed the chair, and President Wolff read his

INAUGURAL ADDRESS.

[For the text of the address see JOURNAL, Oct. 3, p. 523.]

When the reading of the address was finished, Chairman Lloyd, on motion of Mr. Butterworth, referred the message for consideration and report to a committee of three consisting of Messrs. I. Butterworth, J. C. Sterling and W. H. Frost.

The President introduced Mr. Royal Schacklette, of Adrian, Mich., who read his paper on the subject of

COMMERCIAL LIGHTING.

[For the text of the paper see JOURNAL, Oct. 10, p. 566.]

Discussion.

The President—The paper is before you for discussion. I think the author has experienced that which most men at the head of gas companies in small towns have had, in that they have to do the bulk of soliciting in the business districts themselves. Mr. Ewing, will you start that discussion?

Mr. Ewing—I do not know just where to start the discussion, but I think the new business proposition is probably the most interesting. I notice there are some questions in the question box that apply to it directly so I will reserve my discussion until such time as these questions are being considered.

Mr. Cobb—Mr. Schacklette says in speaking of outside arcs that the first trouble is to get one up. My trouble has not been to get the first one up but to keep them from freezing after we get them up.

Mr. Butterworth—Where did they freeze up?

Mr. Cobb—In the line running to the arc on the outside of the wall.

Mr. Butterworth—Could not that be obviated by making the pipe larger?

Mr. Cobb—It could to some extent, but it makes a bungling looking job.

Mr. Lloyd—Mr. Shepard, of Minneapolis, has what he calls a dehydrator. It is of tin, about 12 or 14 inches long, possibly 6 or 7 inches high and 4 inches wide. It has compartments so arranged that the gas must pass through it in a sinuous manner. He fills that simply with lime and seals it hermetically. He puts that into the line at the beginning of the winter, takes it out in the spring, unsolders the cover, removes the lime and replaces it. He says he has never failed to cure any difficulty of freezing of outside arcs. An illustrated description of it is in the AMERICAN GAS LIGHT JOURNAL, March 7, 1904, p. 371. He has several hundred of them in use. I think if they work in the Minneapolis climate they ought to work anywhere.

Mr. Frost—Such an apparatus was shown at the last meeting of the Association. I had some experience in outside lighting in that respect, and found it very satisfactory; just inside the wall where we have the trouble we put in a drop similar to a drip, and fixing a tee sufficient to carry a pint of wood alcohol. The fumes of the alcohol passing through the arc will answer the purpose. It has resulted in taking care of 6 arcs without ever freezing up for 2 years. In the fall of the year when the frost comes, take off the cap, let out the old wood alcohol and fill it again. I find that the alcohol has taken care of our outside arcs all winter, and for 2 years I have been successful. I have also had like success with services.

Mr. Stebbins—Out of 20 outside arcs put up in Kalamazoo, only 2 lights troubled us by freezing up. We put a drip outside about 3 inches long, then open that up when necessary and draw out what little moisture accumulates.

The President—Where did you place the drip?

Mr. Stebbins—Right back of the lamp. It did not seem to freeze at the wall. There are more than 20 up now—we keep putting them up all the time. Originally I was a little bit skeptical about the trouble in freezing, but have no fear of it now.

Mr. Ewing—From which direction did you point the drip?

Mr. Stebbins—Straight down. Most of these run straight out from the building and then this drip made a tee, about 3 inches long. We very seldom have to open them.

Mr. Schacklette—What size pipe did you run to these lights?

Mr. Stebbins—Three-quarter inch.

Mr. Frazer—I do not understand how any moisture could be drawn out in extremely cold weather.

The President—I do not believe I understand the statement.

Mr. Frazer—Mr. Stebbins stated he opened this drip and drew out the moisture. How can that be done?

Mr. Stebbins—Not enough moisture collects there to ever have to open it up. We are not troubled in extremely cold weather, but when the temperature suddenly varies the drippings seem to take place.

Mr. Butterworth—I think it is apparent to all gas men that a very serious matter with us now is how best to remove the moisture from our gas. The moisture difficulties are increasing to the point of becoming a more serious matter. People are now using gas for various domestic purposes more than ever before. They not only light with it, but cook and heat bath water with it, and also take the chill off the room with it. An important question is the complete desiccation of our gas at the works. I have been investigating that a little bit and later on may have some figures to present on the subject. This freezing of arc lights is an occasion in point. An outside arc is a good thing, if you can keep it from freezing. I want to say Mr. Schacklette covers the question of outside arcs, and I think he is on the right line in that it draws our attention to the important matter of the extension of our market. It is becoming more and more recognized that the gas arc is a very important means of increasing our market.

Mr. Douglas—Has Mr. Schacklette or anyone else ever made any tests, not on any particular one arc light but on the installation of arc lights, as to the amount of gas used in a by-pass.

Mr. Schacklette—The more the better.

Mr. Douglas—I don't agree with Mr. Shacklette that the more the better. It might increase the customer's bill to such an extent as to put the arc light out of the competition.

Mr. Schacklette—I never had a complaint about the size of a bill on an arc light.

The President—You have been extremely fortunate, or else the saloons in Adrian close at the time the law specifies that they shall. I think the only fault we have had on big bills comes from saloons that run long hours and are in dark places. We installed some arc lights in those places and found we could not hold the business, because the electric light company give these people who burn current through a long number of hours a very low rate.

Mr. Schacklette—I think there is only one saloon in Adrian using electric light and I am inclined to believe the proprietor is thinking about changing.

On motion, a vote of thanks was passed to Mr. Schacklette for his paper.

On motion, a recess until 1:30 was ordered.

ROLL CALL

Honorary.

Campbell, E. D. White, A. H.

Active.

Amsden, C. T.	Eaton, W. M.	Morgans, F. E.
Bowne, B. L.	Ewing, A. P.	Robinson, B. C.
Butterworth, I.	Frost, W. H.	Russell, H.
Barthold, W. H.	Frazer, D. H.	Sheriff, R. E.
Blowers, F. W.	Freese, F. W.	Seitz, R.
Burnett, G. H.	Gallagher, E. F.	Schaddelee, R.
Cressler, A. D.	Gross, F. L.	Schacklette, R.
Church, L.	Howden, F. J.	Soper, R. G.
Cobb. B. C.	Hellen, J.	Stebbins, E. J.
Challis, P.	Hess, F. H.	Sterling, J. C.
Chamberlain, G. R.	Hubbard, G. H.	Turner, G. E.
Cook, W. S.	Hester, J. G.	Traver, A. F.
Camburn, G. M.	Lathrop, A. P.	Wolff, S. E.
Davis, E. D.	Lloyd, E. F.	Ward, W. L.
Douglas, H. W.	Lynn, J. T.	Whalen, T. J.
Dame, A. M.	Munroe, S. L.	Walbridge, H. D.
Dewey, V. F.	Mershon, C. E.	Zwissler, A. L.
Duffy, I. N.	Morris, H. C.	

Associate.

Barnes, T. R.	Lane, F. A.	Rew, G. W.
Cavanaugh, T. T.	Lovett, E. C.	Russell, R. D.
Cressler, G. H.	Lindsay, G. R.	Slater, A. B.
Clark, H. F.	Leakey, N. A.	Strain, J. R.
Corbus, F. G.	Maitland, E. H.	Stebbins, E. S.
Fricke, C. C.	Milliken, A. F.	Steinwedell, W. E.
Guldlin, O. N.	Mason, C. T.	Street, H.
Hoffman, J. G.	Printz, C. H.	Wickham, L.
Knowlson, A. T.		

(To be Continued.)

[Concluded from Page 571.]

The Formation of Naphthaline in Coal Gas.

[A paper prepared by MESSRS. ALFRED H. WHITE and S. BALL[1], and read at the Twelfth Annual Meeting, Michigan Gas Association.]

In comparing the hydraulic main tests with one another, in addition to the points of difference above noted, we must take into account the differences in sampling necessitated by the arrangements of the works. In Ann Arbor the samples were taken directly from the hydraulic main supplied by but one bench and that the best working one in the retort house. In Grand Rapids the sample was mixed gas from the entire new set of benches and was collected just as the gas was leaving the hydraulic. Most of the gas had, therefore, been in contact with the tar for a longer time than was the case in Ann Arbor. In Jackson the samples were collected from the dead end of the hydraulic main, which as before mentioned had a water seal. The tests differ from one day to another markedly, as was to be expected with varying conditions in the works. However if we average the samples from the three works we find for the total naphthaline in gas and suspended tar per cubic foot of gas from the hydraulic main:

	Milligrams per Cubic Feet.	Number of Samples Averaged.
Ann Arbor	94	0
Grand Rapids	59	2
Jackson	50	3

The higher figure for Ann Arbor might be due to the shorter time of contact in hydraulic main due to the above explained difference in sampling. If this were the case we should expect to find a large decrease after the gas has passed through the foul main and the primary condenser. There is only one date—7/25—when this can be compared definitely, but on that date the total naphthaline per cubic foot was as follows in three samples simultaneously taken:

Hydraulic	128 milligrams.
Primary inlet	129 "
Primary outlet	136 "

These three results may be regarded as being practically identical considering the errors of sampling and analysis. The same result is shown in the only other result available, that at Jackson, 5/11, 3 P.M. where the hydraulic showed 60 and the primary condenser outlet 62. In these two cases, therefore, the slow and quiet cooling has failed to throw out any of the naphthaline and the larger amount of total naphthaline in the Ann Arbor gas at the hydraulic cannot be ascribed to difference in method of sampling.

The above figures have been on total naphthaline. We have sought to differentiate the naphthaline present into that dissolved in the mechanically suspended tar and that present as vapor by introducing a tar filter into the gas pipe as before described. It is impossible, however, to avoid in this slow passage of gas through the tar as it is filtered out a very thorough scrubbing of the gas by the tar. The amount of naphthaline that passes through the filter represents then the amount which the tar could not take out under any circumstances at that temperature. Looking at the results from the hydraulic main tests in this light, we find for the average results expressed in milligrams per cubic foot gas:

	Amount Naphthaline Not Taken out by Tar Filter.	Naphthaline Filtered out.	Per Cent. Naphthaline Removed by Tar Filter.
Ann Arbor	.9	93	99
Grand Rapids	2.0	57	96
Jackson	27.0	23	46

There is no evidence which will warrant us in saying positively what the reason for this difference is. It is possible that the water seal at Jackson prevents the tar vapors from having a fair chance to come in contact with the gas and saturate themselves with naphthaline. This theory is supported by the analyses of tars drawn from the hydraulic main at the time of the experiments.

Ann Arbor	4.66 per cent. naphthaline.
Grand Rapids	5.35 " "
Jackson	4.2 " "

Jackson shows the lowest percentage, which would correspond to the above theory, but it is not much lower than Ann Arbor. It should not be forgotten that there are many other possibilities arising from different conditions in the three works which we have not been able to investigate, and this theory is advanced only as a suggestion. It may be that the Jackson tar is incapable, no matter how good an opportunity it has, of removing the naphthaline. In future work we shall make tests in such a way as to throw more light on this question.

From the retort to the outlet of the primary condenser the gas is subjected to quiet and undisturbed cooling. In the short space between the outlet of the primary and the inlet of the secondary condenser it is set violently in motion by the exhauster and subjected to violent and intimate contact with tar in the tar extractor. It enters the secondary condenser then freed from most of its tar. We may also assume that this tar is by this time holding all the naphthaline which it is capable of taking out of the gas, so that if we now filter out the tar, when taking a sample, we shall be able to obtain a correct idea of the amount of naphthaline actually existing as vapor in the gas at this point. We may also determine from the table of vapor tensions how completely the gas is saturated with naphthaline vapors and what effect subsequent cooling will have. From its importance we have made a relatively large number of tests at the inlet of the secondary condenser and the results are averaged below.

	Milligrams per Cubic Foot Gas. In Tar.	Milligrams per Cubic Foot Gas. In Gas.	Average Temperature Degs. F.	Per Cent. of Saturation of Gas.	Temp. to which Gas would have to be Cooled to cause further separation of Naphthaline.	Number Samples Averaged.
Ann Arbor	4.8	1.8	78	7.1	38° F.	7
Grand Rapids	3.8	3.0	87	7.5	44° F.	2
Jackson	1.7	23.0	118	14.0	76° F.	7

There is omitted from the Grand Rapids average the test made 4/19 A.M. which shows the extremely high figure of 29 milligrams of naphthaline in the gas. It is possible that the figure is correct and due to

1. Mr. Ball is the holder of the Michigan Gas Association Gas Engineering Fellowship, University of Michigan.

some abnormality in the works, but if so it was of short duration as a test made the same afternoon showed only 4 milligrams. The marked difference between the three works is most apparent when the temperatures necessary to produce further deposition of naphthaline are considered. The Jackson gas if it had passed out of the works at this point would have deposited naphthaline at 76° F., while Ann Arbor and Grand Rapids would have stood cooling to 38° and 44° respectively. It is a continuation of the difference noted before that the suspended tar in the Jackson gas was insufficient in quantity or deficient in quality to remove the naphthaline. An indication that it is quantity that is lacking is found in the percentage of napthaline in the extractor tars which is almost identical in the case of Jackson and Grand Rapids, *i.e.*, 7.9 per cent. It would seem then that if there had been more suspended tar in the Jackson gas, there would have been less naphthaline at that point.

Passing on to the results from the scrubbers we note that at Jackson the gas has been considerably freed from naphthaline in the secondary condenser and scrubber, two series of simultaneous tests on 5/11 showing an average decrease of from 31.5 to 13.5 milligrams in passing through the secondary condenser and scrubber. It is probable that in one case the scrubber was removing naphthaline by freezing it out, for the gas left it at 65° F. saturated with naphthaline. The two tests available at Grand Rapids are conflicting, one taken in the morning at the outlet of the fresh water scrubber showing 6 per cent. saturation, while another the same afternoon showed 71 per cent. Tests made simultaneously with these two at the governor to the street main showed no naphthaline, a fact which will be discussed under the influence of the purifiers. The amount of naphthaline passing the scrubber-washer in Ann Arbor was in all cases small, although in one case 4/1 A.M. where the gas left the scrubber-washer 5° F. warmer than it entered the secondary condenser it had actually gained in naphthaline. This gain probably came in the tar washer where, owing to floods having broken the tar offtake pipe, the tar remained in the water an undue length of time. When finally drawn off a month later the tar from this tar washer contained 12.4 per cent. naphthaline. It is, therefore, entirely probable that a slight variation in temperature would cause it to give up naphthaline to the gas.

The purifying material would scarcely be expected to exert any influence on the naphthaline. Certainly there can be no question of chemical action. We have already alluded, however, to the test at Grand Rapids 4/21 P.M., where the outlet to the fresh water scrubber showed 11 milligrams naphthaline while the governor to the street main showed nothing. A test at Jackson 5/11 A.M. showed 16 milligrams at the scrubber outlet and only 4.5 at the outlet of the purifiers. This indicates that the purifier is capable under some circumstances of removing naphthaline. We have before mentioned, in discussing methods of analysis, that the lime used in our drying train was capable of removing a considerable amount of naphthaline from the gas and holding it with some tenacity. By passing air free from naphthaline over lime it could subsequently be completely removed. The naphthaline is probably held by some form of surface attraction often called absorption. We might expect an analogous action in the case of the iron oxide purifiers. Analysis of foul purifying material from a newly opened box in Ann Arbor showed practically nothing, as was to have been expected from the extremely small amounts of naphthaline observed in the Ann Arbor gas in the scrubbers and condensers. A sample of foul purifying material from Jackson showed .06 per cent. by weight of naphthaline. Calculating back to volume this corresponds to 12.5 grams per cubic foot of purifying material, or 17,500 grams per box, 20 feet by 20 feet by 3.5 feet, which is the size used in Jackson. Taking the average of our figures for the naphthaline entering the Jackson purifiers at 13.5 milligrams per cubic foot, this corresponds to 4,536 grams naphthaline per day. If the purifier removed three-fourths of this as our figures show, it would purify the entire output to that extent for 5 days before becoming saturated. The purifiers may thus exert a very important influence as a balance wheel in controlling irregularities in naphthaline. It will store up a very considerable quantity of naphthaline and will slowly give it back to a gas low in naphthaline and receive more in turn from a richer gas. It is helpless in the face of continued naphthaline supply unless the boxes are frequently changed, and the foul purifier revivified by exposure to the air, which will ultimately remove all the naphthaline.

In summarizing the contents of this paper we may say that it presents for the first time a method for estimating naphthaline in crude gas and small quantities of tar and includes a redetermination of the vapor tension of naphthaline and the influence of various gases and vapors upon it. By the help of these methods and data it is possible to trace the naphthaline through the condensing and purifying apparatus and show step by step the elimination of naphthaline. Data are presented of tests made in this way in 3 works. It would be folly to try and draw any sweeping conclusions from the tests of the 3 works as given here. The very powerful influence of the tar in removiag naphthaline as shown at Ann Arbor and Grand Rapids must, however, be conceded as worthy of most careful study. It may be due to the coal used, the arrangement of the works, or the manner of operating them. Every further test will throw new light on the subject and the work will be prosecuted diligently during the coming year.

APPENDIX.

Bibliography of the More Important Papers on the Naphthaline Problem.

Allen, R. W.—The Presence of Naphthaline in Coal Gas.
Jour. Soc. Chem. Ind., 1,900, 209.
See also *Jour. Gas Lighting*, 75, 673, 1,003.
AMERICAN GAS LIGHT JOURNAL, May 7, 1900.
Gives amount of naphthaline required to saturate a gas at different temperatures from 0–100° C. Found to be independent of the nature of the gas, aud unaffected by vapors of benzol, alcohol, ether, etc., provided the gas is only partially saturated by such vapors.

Birchmore, W. H.—Naphthaline.
Read before the Western Gas Association. Reprinted AMERICAN GAS LIGHT JOURNAL, June 22, 1903, and following numbers. A comprehensive study of the possibilities of naphthaline formation.

Botley, C. F.—Removing Naphthaline by Introducing Petroleum "Oil Fog" into the Gas.
Jour. Gas Lighting, 64, 1,108.
Oil is sprayed into purified gas by means of spray pump. Full description of apparatus.

Browne, A. F.—Coal Gas Condensation. A Theory.
Jour. Gas Lighting, 79, 1,263.
Gives table showing amounts of various vapors in gas and work required to remove each. Amounts of water vapor in gas at different temperatures.

Bueb, J.—Gas Purification with Recovery of By-Products.
Jour. für Gasbeleuchtung, 43, 747.
See also *Jour. Gas Lighting*, 74, 308.
Scrubbing with heavy tar oil containing 3 per cent. benzol.

Bunte, H.—Naphthaline and Benzol in Illuminating Gas.
Jour. für Gasbeleuchtung, 35, 569.
Theory of formation and decomposition of hydrocarbons in coal distillation. Gives percentage of distillation products in gas and tar. Too little benzol ever to be chilled out. To prevent solid naphthaline chilling out, vapors of a liquid should be present of approximately same vapor tension as naphthaline which would condense out with the naphthaline and dissolve it.

Carpenter, Chas.—Gas Exhausting and Condensing.
Jour. Gas Lighting, 66, 1,025 and 78, 1,306.
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Colman, H. G.—The Condensation of Coal Gas.
Jour. Gas Lighting, 79, 1,486.
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Colman, H. G.—Report of the Naphthaline Committee of the Southern District Gas Association of England.
Jour. Gas Lighting, 85, 765.
Comparison of the amounts of naphthaline and benzol vapors in purified gas from various English works.

Colman and Smith.—Estimation of Naphthaline in Gas.
Jour. Gas Lighting, 75, 798 and 80, 1,277.
Picric acid method for estimation of naphthaline in purified gas.

Doty, Paul.—Causes Underlying the Formation of Naphthaline and their Prevention.
AMERICAN GAS LIGHT JOURNAL, 70, June 26, 1899.
Jour. Gas Lighting, 74, 233.
Discussion of various proposed remedies. Best remedy for naphthaline in water gas is to use a hot water washer.

Eitner, Paul.—Contribution to the Naphthaline Problem.
Jour. für Gasbeleuchtung, 42, 73 and 89.
Theory of formatton of hydrocarbons in coal distillation. Tests of various solvents such as alcohol, benzol, petroleum, naphtha, etc., to prevent deposition of solid naphthaline.

Glover, S. and T.—New Departure in Carbonizing, Having for Its Object Prevention of Naphthaline Troubles and Providing a Cheap Enrichment.
Jour. Gas Lighting. 71, 1,559.
By distillation of coal at low temperature, little naphthaline formed, but rich gas containing large amounts of hydrocarbon vapors capable of dissolving naphthaline. By distilling 10 per cent. of coal at low temperature, the remainder of the gas is enriched and naphthaline deposition prevented.

Haber, Fritz.—Decomposition of Hydrocarbons by Heat.
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Irwin, W.—Presence of Naphthaline in Coal Gas: Its Detection and Extraction.
Jour. Gas Lighting, 75, 1,282.
AMERICAN GAS LIGHT JOURNAL, June 25, 1900.
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Kunath, E.—Naphthaline in Illuminating Gas.
Jour. für Gasbeleuchtung, 34, 529.
Jour. Gas Lighting, 59, 109.
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Kuster, F. W.—The Acidimetric Determination of Naphthaline Berichte, 27, 1,101.
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Leather, J. P.—Naphthaline Deposits: Their Cause and Prevention.
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AMERICAN GAS LIGHT JOURNAL, July 17, 1899.
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Mitchell, W. K.—A Method Successfully Employed to Obviate Trouble from Naphthaline.
Proceedings American Gas Light Association, 14, 62.
AMERICAN GAS LIGHT JOURNAL, 67.
Jour. Gas Lighting, 70, 1,115.
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Prevents precipitation of naphthaline and increases candle power.

Russell, C. P.—Naphthaline. The Cause of its Formation and Means of its Prevention in Free State in Gas.
Jour. Gas Lighting, 67, 20.
Cause wet slacked coal. Keep retorts at uniform heat. Remedied by effective condensing apparatus and especially by removing moisture from gas.

Smith, J. F.—Solubility of naphthaline.
Jour. Gas Lighting, 79, 1,270.
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Smith, Watson.—Naphthaline Obstructions in Gas Service Pipes.
Also, Variations in products of Distillation of Various Gas Coals.
Jour. Soc. Chem. Ind., 8, 949.
Gives tables of amounts of gas, ammonia, tar, naphthaline, etc., from various English coals.

Young and Glover.—System of Elimination of Naphthaline.
Jour. Gas Lighting, 70, 16 and 80, 1,263.
Heavy tar collected, cooled and used in scrubber to wash gas. Suggest distilling part of coal at lower temperature to give illuminants and light hydrocarbons to dissolve out naphthaline.

Young, William.—Quantity of Naphthaline in Gas.
Jour. Gas Lighting, 74, 755.
Claims that gas will hold a variable amount of naphthaline depending on the amount of other hydrocarbon vapors.

Young, William.—Naphthaline from Retort to Point of Deposition.
Jour. Gas Lighting, 75, 1,712.
AMERICAN GAS LIGHT JOURNAL, July 16, 1900.
Describes how naphthaline deposits in different parts of the works. Recommends washing with heavy tar oil containing benzol or reversing flow of gas through condenser.

Comments on Specifications for Protecting Embankment Slopes.[1]

Specification clauses governing the seeding of embankments are seldom to be found when wanted in drawing specifications, for which reason the following clause from an Ohio specification may well be placed on record:

The contractor shall seed all surfaces of the embankments which have been finished with top soil and other surfaces as may be directed.
The surfaces to be seeded shall be carefully prepared and raked over and then seeded with grass seed, using at least 50 pounds per acre, and consisting of a mixture of 4 parts beech grass, 4 parts Hungarian brome, 4 parts orchard grass and 1 part of white clover, together with not less than 400 pounds of raw bone fertilizer per acre, and all well rolled. All seeded surfaces shall be carefully tended by the contractor, shall be watered and the grass cut when necessary, and shall be turned over to the city in good condition on the final acceptance of the work.

The protection of slopes with a slope wall or stone paving is often specified, but seldom are the specifications drawn with good judgment, unless the engineer has had considerable experience in this class of work. The following clause will serve to illustrate some of the common errors of omission and commission:

The paving blocks shall be hard, durable limestone, free from cracks and flaws. They shall be even faced, straight edged stone, approximately rectangular in shape at the faces, and so split or dressed as to give a joint not exceeding 1 inch anywhere at the face, and not exceeding 3 inches at any point. The stone shall be from 20 to 30 inches in length, not less than 8 inches in width, and approximately 18 inches in depth, measured at right angles to the slope. The paving shall be laid in regular courses, with the heavier courses at the bottom. The cross joints shall break joints at least 10 inches, and, after the stones have been set, all joints shall be filled with clean gravel and the faces of the joints shall be thoroughly chinked with spawls well driven in. In case of any sliding or settling, the work shall be reconstructed.

In the drawing of specifications for slope wall masonry of this kind it is essential, if economy is aimed at, to examine the quarry from which the stone is likely to come. There are many limestone quarries having thin bedded upper layers which may be split with a hammer to stones ranging from 4 inches to 12 inches thick on the face. In other limestone quarries it requires plug and feather work to split the stones into desirable sizes. In the latter case there is no objection to naming 8 inches as the minimum thickness of a course, for it can be relied upon that the contractor will split his stone as thick as can be handled without a derrick in the laying. On the other hand, stone found in thin beds that can be split with hammers, without plug and feathering, should not be limited in thickness to 8 inches, for an excellent slope wall can be built of 4-inch stones.

Another feature of this specification that will add to the cost of the work, without adding to the durability or serviceability of the wall, is the requirement that the wall shall be laid in "regular courses." These two words look innocent enough on paper, but we have known instances where they have actually doubled the cost of a slope wall. There is no necessity of laying a slope wall as if it were a street pavement, in regular courses. As long as the stones are well bonded by overlapping, and not more than, say, 3 thin stones are placed one above the other to equal the thickness of a large stone, the wall can be counted upon to serve its purpose. A 10-inch overlap, as above specified, means the use of no stone less than 20 inches long, and the breaking of joints precisely in the middle of such stones. This again is wholly uncalled for in slope-wall masonry. An overlap of, say, 4 inches (except where 2 or 3 stones are used to even up with an adjoining thick stone) is sufficient for all practical purposes. The minimum length of stones may then be reduced to, say, 10 or 12 inches.

There appears to be an unfounded fear that comparatively small stones in a slope wall on a river bank will be displaced either by ice, driftwood or boats. But the fact is that a slope wall of comparatively small stones, bonded as above outlined, has a remarkable resistance to displacement, as may be readily tested by an attempt to remove any one of its stones with a pinch bar, and as may be ascertained by examining old walls that have been subjected to no slight amount of ice pulling and battering.

As to the depth of a slope wall on a river bank, from 12 to 16 inches will suffice if the wall is properly "lined" (*i. e.*, backed) with gravel or broken stone. The clause under discussion makes no such provision, and is consequently a poor clause for general use. Eddies of water will tend to wash out the earth back of the slope wall in spots, causing settlements; and the flow of rain water down the slope back of the wall will be even more destructive in many cases. It is true that the clause calls for chinking of the joints with gravel and spawls, but gravel of a size that can be swept in with a broom can be swept ont by a current of water; and, as for spawling face joints only 1 inch wide, we may add that it is one of those provisions that look well on paper but do not work out so well in practice. Moreover, neither of these methods protects the wall from settlements due to the washing away of the earth back of it by descending rain water.

Finally, we may say that 1-inch face joints are usually not to be had, except at an expense wholly incommensurate with any advantage thus obtained. There are, it is true, some very flat bedded stones in certain quarries, but we are now speaking of the general run of stone used for slope wall purposes. Where granites are to be used, the specifications must be far more lenient in the matter of sizes and dressing than we have indicated, if a reasonably cheap slope protection is to be secured.

Embankments are not so often protected by sodding as they would be were it not for the cost, which usually ranges rrom 6 to 25 cents per square yard. That it is not necessary always to cover the full area of a slope with sod is apparent, yet how small a percentage of the full area may be sodded with satisfactory results is not often considered. The following clause from a levee specification bears upon this point:

After the embankment is built in the proper height and dimensions it shall be smoothly dressed to proper slopes and the entire surface planted with living sods of Bermuda grass not less than 4 inches square, placed

1. *Engineering News.*

not more than 2 feet apart. The sods shall be covered with 1 or 2 inches of earth as directed.

If these squares of sods are placed 2 feet c. to c., they form less than 3 per cent. of the total area; if they are placed 2 feet apart in the clear, as the specification seems to permit, they cover only 2 per cent. of the total area. In our issue of June 2 some excellent data on the actual cost of sodding were given. We shall welcome more data on the same subject, particularly the cost of sodding in patches as above described.

Street Lighting.

[A paper read by MR. A. S. HATCH at the last meeting of the International Association of Municipal Electricians.]

The principles involved in outdoor illumination are two, an even illumination of the section under consideration and a brilliant illumination of the street intersections only. The first principle is the ideal lighting, since it more nearly approaches that of moonlight and gives a greatly improved police protection in lighting the alleys and yards as well as the street corners, and is best accomplished by the tower system, although small lamps at frequent intervals on both sides of the street are a snbstitute for lighting the streets only, and on account of the numereus shade trees, are better. But the public will not have either. They insist on having their eyes dazzled, and in commenting on the lighting of a city, it is not with reference to the even illumination but the blaze of light on the downtown streets. In Detroit the lighting commission have endeavored to give the main thoroughfares this even illumination by means of the towers.

The idea of the tower system originated with a windmill contractor who had erected several windmill towers on some buildings in Elgin, Ills., for lighting purposes. In May, 1884, an experimental windmill tower was erected in Cass Park, being made of gas pipe, triangular in cross section and tapering to a point at the top and 22 feet on a side at the base. There were nine 18-foot sections, the first three being of 2½-inch pipe, the middle three being 2-inch and the top three 1½-inch, making the total height 161 feet. There were 6 lamps placed on this tower. It was evident that this style of tower would not be practicable in all parts of the city on account of the size of base required, since in some places the space was so limited that only a pole could be set, so the conditions resulted in the invention of Mr. J. S. Adams, of the tower as finally built by the Brush Company and as still used by the lighting commission. These towers are also triangular in cross section, but the sides are parallel instead of tapering and are built of 2-inch and 1½-inch gas pipe standards, a section being 8 feet 2 inches high and 6 feet on a side. The girths are 1-inch pipe and each section is braced with a ⅝ inch diagonal stay rod. The base of the tower is a single wrought iron pipe 15 feet high; on this is a cast iron fitting to which both the horizontal and brace supports are fastened. The tower is guyed in four directions by two sets of guy ropes consisting of ½-inch steel strand, fastened to wooden stubs. In order to facilitate trimming, an elevator is placed in the center, which, with the trimmer, is counterpoised by a weight. The intense light near a pole lamp is entirely done away with. A pole light so blinds the eyes that, after passing through the bright area, the dark zone between the lamps appears all the darker, while the tower lights are so far above the range of vision that the eye is not affected by the rapid change. This is the result experienced after driving on the boulevard where tower lights only are used and then driving on a street lighted by pole lamps.

There are two methods of electrical distribution, the series and multiple; the former is with a constant current, quantity, and the latter with a constant potential, pressure. Consequently as loss varies with quantity, the first needs one size of wire only, while the second varying as the square of the current and the distance, requires a change in the size of wire corresponding to the changes in the current, thus making a greater cost. For this reason, inventive ingenuity endeavored early to perfect a series system for street lighting, and the first commercial demonstration was on the Avenue de l'Opera in Paris during the fall of 1878 by the use of Jablochkoff candles. In spite of their extremely short life—a single candle lasting about 2 hours—they came into extensive use, and it is only recently that the system was discarded in an Australian city. This system stimulated inventors in the line of the incandescence of refractory materials, and, though dormant for several years, it has been recently revived by the introduction of the Nernst lamp. While the Jablochkoff candles were made of a piece of kaolin melted away by the heat of the arc, in the Nernst lamp the kaolin is heated externally until it becomes a conductor, when it is made to glow by the current passing through it. The light is very pleasant, being between the yellow of an incandescent and the white of an arc, but like the candles it is made for alternating currents only, differing in that it uses a constant potential while they used a constant current. For this reason the Nernst lamp will not be extensively used in street lighting except in the case of frequent lamps along the main thoroughfares in the center of a city, for which it is admirably adapted since it is between the intense light of an arc lamp and the mild light of an incandescent.

The mechanism of the lamp is as complex as was that of the Jablochkoff candles, although used for an entirely different purpose. The aim in the candle was to secure long burning, while that of the Nernst is to secure automatic starting and regulation. The first is secured by a heating coil just above the glower or kaolin pencil and automatically cut out or into the circuit by the heating or cooling of the glower. The automatic regulation is secured by a ballast consisting of a coil of iron wire in series with the glower varying in temperature in inverse ratio to that of the glower, thus keeping the glower at an even temperature and so an even heat and light.

The maximum luminescence of an open arc lamp is between the angles of 30° and 55° from the horizontal, which would be between 18 and 43 feet from the pole with the lamp 25 feet from the ground. Either side of this zone it gradually grows darker. Thus it has been the endeavor to increase this zone or render the luminescence more uniform either by putting the lamps higher or by using shades and reflectors. With the desire to make the illumination more uniform has been the desire to lengthen the hours of burning from one trimming. The first attempt with the open arc lamps was the Wallace lamp, which used plates of carbon set vertically. These lamps would last 100 hours—nearly as long as some of our latest types of inclosed lamps—but the diffusion of light was very poor. During the past 5 years the open arc lamp has been superseded by the inclosed arc, either alternating or direct current, nearly all the principal lighting companies having changed their systems. The open arc lamp was made in two general sizes, the dividing arc requiring from 6.5 to 7.5 amperes and the full arc 9.6 to 10 amperes. The longest life with a double carbon lamp has been about 28 hours, but in all cases, whether using carbon rods or plates, the consumption is about the same—¼ of a cubic inch of carbon per hour—so while there is an increase in the number of lamps to the trimmer, his load is proportionately heavier. The term, open and inclosed, as applied to arc lamps, refers to the condition of the arc, which in the open has the arc unprotected except by a large globe, thus allowing it to be exposed to draughts of air which cause an irregular light.

Attempts were made early to inclose the arc so a longer life and more uniform burning would be secured, but it was not a commercial success until the present form was adopted which is essentially a small glass globe inclosing the lower carbon and tightly fitting against a metal plate through which the upper carbon feeds. Much of the trouble with the early inclosed lamp was due to the poor grade of carbons used, so that for several years after the lamp was on the market nothing but imported carbons were burned. At least one carbon is cored, that is, the center is of softer material than the outer part, which is to secure better control of the arc. Some users claim to secure better results from the series alternating lamp by using both upper and lower carbons cored. The inclosed arc lamp is about the only one being installed now either on direct or alternating current circuits.

In many of the large cities, constant potential lamps are used on the commercial mains, being turned off and on by boys or trimmers in the center of the city. The outer sections of the city are lighted by the series system, either alternating or direct. Although the inclosed arc lamp was striven for early, it has only been during the last 5 years that it has been extensively introduced, so that to-day in nearly all the larger cities the open arc lamp has been discarded for the inclosed.

Besides the use of the open and inclosed arc lamps for street lighting, there are many incandescent lamps still in use, but mostly in decorative effects. A new electric lamp, the flame, is being introduced, being recommended principally on account of its brilliancy and long life, one form claiming to be as long as the incandescent in life. The popularity of the electric for street lighting is probably due to its brilliant light and the ease in lighting, not needing a lamplighter, although the introduction of electric lamps for street lighting was delayed in some cities by the political influence of these city employees. There are but few of the larger cities who use electricity only in lighting their streets, a majority using gas also, the electric lamps being used on the main streets and the gas on the resident and minor thoroughfares. Other systems in use in the smaller cities and towns use naphtha, acetylene or kerosene, but in nearly all cases as a means of rendering luminescent some refractory substance.

In the classes of construction for electric street lighting, the tendency to low potentials is advantageous since it lessens the danger of both fire and accident, particularly in the center of the city, so if a company is willing to use constant potential lamps on its commercial circuits, it should be encouraged.

A very common method of suspending lamps at street intersections is by the use of a center suspension, but I do not approve of it since it requires two poles with the necessary guys and span wire, which, with the pole lines built in the streets, make a city look like a forest of poles rather than a city of homes. The neatest construction is the use of a mast arm which throws the lamp toward the middle of the street, thus lighting the roadway and both walks and using only one pole which, with the pole lines in the alleys, gives the city the appearance of being quite free from electric pole lines. Early construction placed a switch in the top of the lamp and it has been only recently that the practice of individual switches has been introduced. The advantage of a separate switch is in the ability to entirely disconnect a lamp from the service if needing attention while the circuit is in operation, thus insuring safety in handling and better service in operation. The tendency among manufacturers is to mount the switch above the lamp, but the objection to such construction where mast arms are used is on account of open circuits caused by the continual swinging of the lamp, finally breaking the wire. With the switch at the pole, the wire is rigid to the switch so a patrolman can locate an open more quickly, since in using a battery connected one pole to the positive of the circuit and the other to ground, he will always get the current so long as he is positive of the open. If the switch is on the pole he can short circuit the fixture with its flexible wires and will not be compelled to retrace his steps to the previous lamp as he would with the switch at the end of the mast arm, since an open in the negative cord would not be known until he had gone to the next lamp.

Where lighting is done by contract it should specify the watts at the lamp terminals, the class of construction, the hours of lighting and the method of inspection which refers to the testing of the wattage or the current; the latter can be done by a recording ammeter. The hours of lighting for an every night, all-night service are usually specified as starting a half hour after sunset and extinguishing from ¾ to an hour before sunrise, a total of about 3,750 hours per year. An all-night, moonlight schedule runs about 2,500 hours per year. Deductions for lamps out are generally made, but it should be incorporated in the contract how they are to be computed.

With regard to future methods of lighting, there are in use or proposed three systems, incandescent, heat luminescence and electroluminescence. The first, incandescence, is the principal one, it being that of both the incandescent and arc lamp. The incandescent lamp is made luminescent by the substance, usually carbon, being raised to a degree of temperature at which the radiations begin to appear within the range of vision, but too low for vaporization. As this temperature is increased the efficiency of the lamp increases until at the boiling point of the substance we have the maximum efficiency and light. This is the arc lamp, so we have the incandescent lamp as the lowest and the arc lamp as the highest in efficiency of lighting by incandescence. Within this range lie all the improvements to be derived from carbon, but combinations of carbon with other substances will improve the light by changing its color and in some cases, as in the flame lamp, increase its luminescence. There are several metallic oxides which have an abnormal degree of radiation at intermediate temperatures. This is heat luminescence, of which the principal examples are the Welsbach gas mantle and the Nernst lamp. The intermediate temperature of the glower in the Nernst lamp is considerably below that of the carbon arc, so its efficiency cannot be expected to be above the arc lamp and this is proven by tests. For this reason also that the cost of a Nernst lamp of equal candle power is about the same as that of an arc, its substitution for arc lamps will be only where the care is a desideratum, although it will make a field between the arc and the incandescent lamp. Electroluminescence is the radiation produced by non-conducting gases and some solids in a vacuum under electric stress. These are Geisler and X-ray tubes. Metallic vapors carrying current at moderate pressure in an inclosed space will give a luminous arc similar in appearance to that of the tubes but of far greater volume. This class of lamp does not depend on temperature for its luminescence. From this it is evident that improvement in efficiency will be principally along the lines of substitutes for carbons in the arc lamp and improvement in metallic vapor lamps, particularly in regard to color.

Thus far we have been considering electric street lighting. The street construction cost for electric and gas is about the same, so any economy is in the operating only. The cost of a gas jet per year is about one-third that of an arc lamp, the light is about one-thirtieth, so as regards illumination the investment is a poor one. For the same reason the use of incandescent lamps would prove a poor investment. During the past 2 years all series incandescent lamps have been discarded in Detroit and arc lamps substituted. The problem to-day is to have enough light where needed and still not too much, that is, lamps of different wattages burning on the same circuit. There are places in a city where 450-watt lamps are required and other where a 250-watt lamp or even less would be sufficient. As an illustration, where two streets intersect in the business section a small lamp on each corner would be best since there would be no dark places in case of street cars or heavy traffic, but at another street intersection one 450-watt lamp in the center of the street would be sufficient. Again, when side streets leave a main thoroughfare in opposite directions but at slight distances apart so that one lamp cannot light both ways, if the regular lamp is placed at the intersection of one street, a smaller lamp would be sufficient in the middle of the block in the other. Possibly the simplest way of accomplishing this would be with duplicate circuits at least half the distance, which, on the basis of costs to the Commission in Detroit, would be about $20 per lamp. The saving in power would amount to $7.50 per lamp. If the alternating system is used, a series transformer could be installed at a less cost. In the case of small towns and isolated locations it may not be desirable to have an electric circle, then individual acetylene or naphtha burners could be used, but they should be large enough to do more than make darkness apparent.

Holiday Gleanings.[1]

By a Gas Works Foreman.

Having passed through what is generally considered the most trying time of the year for the foreman of a medium-sized gas works (I refer to the period starting about the Christmas holidays), keeping the make up to regular working, etc., and having then put the works and plant in good order to meet the following winter's requirements, I spent a little leisure time, between the finishing up of the works' repairs generally and the time fixed for my summer holidays, in looking through a few back numbers of the *Gas World*. In one number, dated March 21st, 1903, I read the report of a meeting of the Southern District Association of Gas Managers, and in the President's remarks I was struck with the following: (1) "Five minutes spent waking up the fireman better than scientific investigation;" and (2) "Wanted, a foreman." The idea then occurred to me that after I got back from my holiday I might put together a few notes from a foreman's point of view as to things I saw which might be interesting to some of my brother foremen. These are now submitted for what they may be worth.

A Story with a Moral.—I well remember when engaged at one works, where the assistant (a nice young fellow and highly trained in the higher branches of the science of gas manufacture) came to me out of the laboratory one day, after completing an analysis of the furnace gases on the regenerator settings, and said: "Foreman, do you know that you are giving the regenerator furnaces too much primary air altogether? You are wasting coke! Though your heats are all right, you are getting them at great expense." I asked him what alteration it would be necessary to make on the "slides" and "dampers" to put matters straight so far as this "waste" was concerned and to get the proper degree of combustion. He then instructed me, on a scientific basis, how so many inches on the "primary" and "secondary" air slides and so many on the damper would just give the necessary percentage of oxygen at the bottom of the furnace grate to give perfect combustion. The heat on the retorts would not be reduced, the necessary saving on the fuel account would be effected, and, in short, "all would be well."

"Well" it was for a time, but within three days the manager came to me in a great rage: "I say, foreman, what is the matter with these regenerator settings?" I innocently replied that the assistant manager told me I was wasting coke—that he had analyzed the furnace gases and found there was over 2 per cent. of free oxygen going up the chimney, and he had, therefore, altered the "slides" and "dampers" to prevent further "wastage" on fuel account. The manager's instructions were forcible and emphatic: "You get the heat to get the coal gas and let him get what furnace gases he pleases." The moral may be drawn by your readers.

Before settling the place at which to spend my holiday I always look round to see what gas works, iron works, gas plant works, coke works or collieries I can visit to see if I can glean anything to benefit my company and make my berth as pleasant as possible. I remember when

1. The *Gas World*.

visiting one gas works—the manager at that time being president of the District Association—I was very much surprised to see the sad condition of the place. There was certainly a very decent water gas plant on the ground, but the oil tanks were almost hidden in the coke heap, the tops only being visible. I asked the foreman if he was not afraid of a fire breaking out in the coke heap. He simply said, "Oh, no! we drowned out the coke in the retort house."

"*The Manager Never Tells Me Anything.*"—When I asked what quantity of gas per ton of coal they made he replied, "I do not know; the manager never tells me anything—I expect he is quite satisfied." (About 6 months after this I happened to see the balance sheet of this particular works, and found the make of gas per ton of coal carbonized was less than 9,000 cubic feet, and the sales were less than 8,000 cubic feet. This was out of a good Durham gas coal. I may say the retorts were set on the regenerative principle). We passed on to the scrubbers, 3 in number, all supplied with strong liquor. I asked the foreman why no clean water was worked on the last scrubber. He answered, "I can't get the liquor any stronger than 4½° Twaddel." I retorted, "Don't you think a little clean water would strengthen it up? It would take the last traces of ammonia out af the gas. At our works we put in about 15 gallons to every ton of coal carbonized in 24 hours." He turned away saying, "It is not what I think; it is what the manager thinks." In the balance sheet of the same works was an item, "Net profit, liquor sold, £11;" whereas at the works I was at, which had only one-third the output, our profit from the manufacture of sulphate of ammonia was over £100.

Our next move was towards a proposed sulphate plant. Part of this plant had been fixed 4 years previously, but there had been nothing done to it during the last two years. We passed on to the governor house, fitted up with two governors, one of which was of the water loading type. I had never seen a water loading governor before, and was very much interested in it. I asked him if they could depend upon it working at the proper time without having to be attended to personally. His reply was, "Decidedly not. We have to look after it on nights when we expect a heavy consumption." The other governor was a single valve with a counterbalance lever, on the end of which was hung a corned-beef tin, partly filled with water as a balance weight.

By-Product Coke Ovens.—My next visit was to a colliery with from 70 to 80 by-product coke ovens. Under the guidance of the foreman, I had a look round the whole of the plant. Everyone employed seemed to do his work well, but only by rule of thumb—*i. e.*, through having seen it done before, as they did not seem to understand it. I was interested in the coke ram for discharging the ovens—a system which I see is coming into vogue now in gas works—I refer to the Paris and De Brouwer dischargers. Fancy seeing a wall of hot coke, 20 feet long, 6 feet high and 20 inches thick, being pushed out and slaked on the bench. Here was standing a crane and coke grab, though it was not in use, as it broke up the coke. There was a very neat sulphate plant. I was told the effluent liquor was cooled down and passed through and through the scrubbers. The sulphate was only of a dark grey color. There was also an aerial flight for conveying the coal from a drift in the hillside across the valley, a distance of about a mile.

I next visited a gas works of very ancient design with a make of about 24,000,000 cubic feet per annum, with a "parochial manager," as Mr. Corbet Woodall would say, who never sees anything out of his own parish. He told me himself that he only kept his exhauster running during the daytime, summer and winter alike. Even in winter, with all retorts in action, he kept his engine standing during the night.

"*Wanted, a Foreman.*"—My next call was at a gas works sending out about 100,000,000 cubic feet per annum. On inquiring at the gates for the foreman, I was shown a chap, dressed in moleskin trousers and vest, cleaning old ascension pipes. My thought at the time was that the company were "saving at the tap and wasting at the cask end." All the men in the yard knew where the foreman was; and it is certain that he could not both work and see that they did their share. On going into the retort house it was easy to see that a great waste was going on there. The retort lids, all self-sealers, were blowing. I could hear plainly enough that the dip pipes were all sealed in tar; there were no means of flushing the hydraulic mains—gas and tar flowed together until they reached the condensers. I gathered that they had had a lot of trouble with the hydraulic main getting pitched up, and had to stop making gas, even in winter, for 10 or 12 hours to steam it out! I was very sorry for the foreman; he had no time to spare; for if the manager saw him "wasting his time," as he called it, he would kick up a row. So I bade him a hasty "Good afternoon," as I did not want to get him into trouble."

Seeing the Coal Got Out.—My steps were next directed to a large colliery where they lift from the mine about 1,600 tons of coal per working day, and from two shafts 100 fathoms deep, and make about 180 tons of coke per day—about 60 tons of this coke from washed coal. Between the end of the stacks of coke ovens and the chimneys are placed 6 large boilers, heated by the waste gases from the ovens, generating steam for the conveyor engines, coal elevators and washing machines. The surplus goes to the colliery for the various engines. The parish council have the streets and lanes lighted with about 240 electric lamps of 16-candle power. I believe this was the first electric installation under the Parish Council Act. The council pay the colliery company 34s. per lamp per annum of 1,300 hours, the company doing all repairs and renewals. The colliery agent, a very enterprising man, has erected a larger electric power station to drive electric coal cutters in the mine, and has also made, by the company's own workmen, a coal conveyor about 50 yards long, taken down the mine to carry coal from the coal cutting machines to the horses—this to save the cutting up of the bottom to make height for the horses to travel over. The conveyor will, of course, have to be moved about every two days, and is not a fixture. It will be steadied by the setting of props along its sides. Its height and width are about 20 inches over all and it is driven by an electric motor. I was very much surprised when told that they had put in a coal drift about 800 yards from the surface a 6-horse power gas engine to haul out the coal, and that it was giving every satisfaction. I should think this is the first gas engine used down a coal mine. I was very pleased to see that they had also a gas works, carbonizing about 500 tons of coal per annum. It had the appearance of being well looked after, unlike so many of the small works one sees in passing up and down the country.

I think it would be a good thing for most gas works foremen if they could spend a few hours at the colliery from which they get their coal. They would then be better able to judge of the coal as it comes into the gas works. It must be remembered that there are many different kinds of coal drawn up the same shaft. I mention this because I managed a small colliery gas works for over seven years, and have seen gas coal, steam coal and house coal all put into one wagon of 10 tons. I have also seen scores of times, at another colliery of the same company, gas coal and coking coal mixed into the same wagon. I think it would be money well spent for directors or gas committees to send the foreman on a surprise visit to the pits from which the coal is drawn.

Profits Made in the Retort House and Lost in the Streets.—A works making about 30,000,000 cubic feet per annum next claimed attention. On inquiring for the manager I was told he was down the subway of the new retort house. This house was just on finishing point, and they were heating two of the beds on the regenerative principle. It was a very nice house, containing 5 beds, with room for 3 more. In looking around, as a practical man will do, for something new or very old, I noticed that, as is very often the case—I don't know why—there was no tar take-off, though each bed had its own branch and regulating seal valve from hydraulic main. I asked the manager why there was nothing to take the tar away except the foul main, and his response was, "Oh! I don't think there is anything in that. Anyway, we are not going to put anything of that kind in this year." This manager, I found, having served his time as a gasfitter, knew more of fixing gas brackets and pendants than of managing a retort house. I sometimes think that directors of small works make a mistake when they give preference to men who can fix meters better than they can charge retorts or lay gas mains. Profits are still made in the retort house; and sometimes they are lost in the street.

I next visited a larger works sending out over 100,000,000 cubic feet per annum. On inquiry at the gates for the works foreman I was directed to a gang of men standing looking at one man working. On asking for the foreman, the man who was working looked up—he was fixing an hydraulic valve for the sulphate plant oxide purifier—and on my telling him my mission he told me he would only have a few minutes to spare, as the men would all be waiting until he went back again to them. On moving into the engine room I saw there was no less than 30-tenths vacuum on inlet of exhauster. We then went into the retort house where you could hear the gas plunging among the tar. I asked him what seal he had on in the hydraulic and he said, "Only 40-tenths, but then there is 30-tenths pull; that leaves 10-tenths seal on." Just then the manager came on to the works, so he bade me a hasty adieu.

A Gas Plant Works.—My next visit was to the works of a large gas plant contractor. I had the pleasure of being acquainted with one of the draughtsmen and I spent three very interesting and instructive hours going through the different departments, seeing gasholders and other plant ready to go out for erection. In going through the ma-

chine shops it was very interesting to notice all the different kinds of labor saving appliances. So, too, in the large foundry in which they were casting, in segments, tubes for railway tunnels as well as tubing for pit shafts. We next turned to the drawing office, where I saw plans of all kinds of gas plant, from the smallest weighing machine to one of the best, if not the best, stoking machines on the market.

About Naphthaline.—In conclusion, I gave a turn to a corporation gas works. It had the finest entrance I have ever seen to a gas works. I had to pass a large greenhouse on my way to the assistant manager's office. I was sorry I had not the pleasure of seeing the foreman, though the assistant manager was very kind indeed—not like a lot of young men who are serving their time to be engineers, who think, and even say, that the foreman does everything by rule of thumb. These works were in very good order, and specially clean for a special purpose. The thing that interested me most was a carburettor for the prevention of naphthaline. I asked my cicerone if they had any trouble with naphthaline, and he said they had a few complaints in the town. "Do you have any on the works?" "Oh, yes? A few weeks ago we had the outlet of one of the holders completely blocked." "And how did you move it," I inquired. "Oh, we plunged it—that is we filled the pipe with cold water to about 4 feet from the top, nnd took the flange off and made a plunger to fit the pipe very neatly with a rod attached, and had 4 or 5 men working it for 2 or 3 hours, then put the flange on again, pumped the water out, and got the gas through straight away." I asked him if they had got the napthaline out. "Oh, I don't know about that," he replied. I told him my way of dealing with a stoppage of that kind. I get a quantity of solvent naphtha, according to the size of the pipe which is stopped, and pump it through and through—that is, put it through the top of the holder and pump up again, and run it through again and again. I have cleared a 24-inch pipe in this way. The naphthaline was 22 inches thick, and this cleared every particle away.

The end of my holiday came all too soon, and I wended my way home again, a tired, but, I hope, a much wiser man.

A Gas-Driven Electric Light Plant.[1]

An instructive and well illustrated article on this subject appeared in last month's issue of *Public Works*. The author is Mr. Arthur H. Allen, who is the Assistant Editor of a well known electrical journal, and therefore has had exceptional opportunities for studying his subject. Though the particular plant with which he deals is driven by producer gas, there are certain considerations in the article which should not miss the attention of gas engineers.

It is, as Mr. Allen says, a singular fact that, in spite of the extraordinary progress which has been made during the last few years in the design and construction of large gas engines, there is but one large public installation of electric generating plant in this country—that of the Urban District Council of Walthamstow—which is entirely driven by producer gas. It is true that attempts have been made from time to time to utilize gas engines for generating electricity for public and private light and power supply—notably at Coatbridge in 1894, at Belfast in 1895, and at Northwich, King's Lynn, Redditch, Saltburn and Galway. The two first mentioned have now abandoned the use of gas engines entirely, and Northwich is supplied, at a very cheap rate, with Mond gas from the works of Messrs. Brunner, Mond & Co. None of the other stations has ever attained any conspicuous success; and in one instance—that of King's Lynn—the gas engines are being displaced by steam. Yet none of these stations contains plant of half the capacity of the Walthamstow Electricity Works, which have been remarkably successfnl in every way. Mr. Allen overlooks the contract the Northern Counties Electricity Supply Company have entered into with the Malton Gas Company for the supply of gas for their engines at 2s. per 1,000 cubic feet.

However, the reasons why the results generally obtained have been so discouraging are not far to seek. First, the generating sets have been of absurdly small size, and often the dynamos have been driven by belts from the engine fly-wheels. Secondly, the plant has not been the best adapted for central station work. Thirdly, the plant has been placed in the charge of an engineer whose whole training has been associated with steam engines, and who, when extensions are called for, not unnaturally prefers to instal the kind of machinery with which he is best acquainted. Among other important reasons which have contributed to the want of success of gas-driven plants, Mr. Allen places town gas, which, he says, is comparatively costly, besides being far less suited for use in large gas engines than a gas of lower thermal quality, and containing a lower percentage of hydrogen. But, apart altogether from the question of working cost, that of the nuisance due to vibration caused by the motion of the reciprocating parts of the engines and by the escape of the waste gases from the exhaust pipes must be reckoned with. The trouble sometimes met with of back firing, has also given rise to serious complaints. In fact, it was owing to the last mentioned fault, that the gas-driven plant at Leyton was shut down; an injunction having been obtained by a resident in the neighborhood to prohibit the continued working of the engines. A similar case occurred this year at Ryde, where a new power station, driven by gas engines, was shut down by injunction on account of the nuisance to neighbors, whose property was eventually purchased by the Electricity Company, as the best way out of the difficulty. It is clear, therefore, that one of the most important considerations in laying down a gas-driven plant is that of choosing a site where no trouble due to the vibration nuisance and back firing need be feared. An alternative, however, is to select a type of engine which is free from both vibration and misfires; and this is the case to a great extent at Walthamstow. The station, in fact, is situated in close proximity to a number of dwelling houses, but nevertheless has escaped from the persecution which has befallen so many of its like.

It is truly pointed out by Mr. Allen that, although the system of gas producer, cleaning plant and engine is not altogether free from complication, the first impression received by the visitor to a gas-driven plant is that of the simplicity of the installation. The impression is on the whole justified, for a steam plant equipped with all the modern accessories devised for the purpose of securing small economies, is far more complicated than the gas plant. "The latter possesses an enormous advantage in that the gas is neither hot, nor at high pressure, nor can it be condensed in the pipes." Hence costly pipes, elaborate pipe coverings, and automatic traps are not needed. Condensers, with the corresponding air and circulating pumps, economizers, feed water heaters, superheaters, chimney shafts, expansion joints, ring mains, and a superfluity of stop valves—all these are dispensed with, together with their inevitable losses. Instead, there remain usually a small boiler, one or more gas producers, low pressure piping, cleaning plant for the gas, a gasholder, starting gear for the engines, and the engines themselves. In either case a supply of cold water, or a cooling tower to cool the hot water from the condensers or the water jackets as the case may be, must be provided. The electrical plant, from the dynamos to the switchgear and cables, remains unmodified by the substitution of gas for steam as the prime mover. The staff required to work the station, and the quantity of fuel used for a given output, are both materially reduced; and as these are important items, the resulting economy is considerable. The capital cost, including all accessories, is not materially different from that of a steam-driven plant; the principal items being the engines. The working cost is unquestionably less, provided the right type of engine is adopted, and the plant receives reasonable care.

At Walthamstow, there are 7 Dowson producers, and the gas is made continuously as required. But a 25-foot gasholder is provided to insure a uniform supply to the engines; and a second one is shortly to be installed. The cost of the gas, including fuel, wages, repairs, etc., is said to be 2¼d per 1,000 cubic feet; but, as the gas has only one-fourth the thermal value of coal gas, its net cost in comparison with the latter is 10d. The consumption of fuel is less than 1 pound per brake horse power-hour, as compared with three times this quantity for steam plant under similar conditions. As a matter of fact, in ordinary working, owing to the unfavorable conditions, many electricity works with steam-driven plant use from 6 to 9 pounds of coal per brake horse power-hour; much fuel being employed in keeping up steam when the load is very light, and getting up steam in cold boilers. From most of these stand-by losses, gas-driven plant is free. Repairs in the case of a gas producer are also a tmall item as compared with that of a steam boiler, especially if the latter be of the water tube type and the feed water dirty. Add to this that a gas engine can be started up and put on load within about 2 minutes, while a steam engine has to be warmed up gradually before it can be used, and it will be seen that the former has some decided advantages over the latter for electricity supply station conditions.

The plant at present installed consists of 4 small and 3 large generating sets; the dynamo being in each case coupled direct to the crank shaft of the engine. The smaller engines are rated at 135 indicated horse power each, and run at 260 revolutions per minute; the large ones are rated at 300 indicated horse power each, and run at 200 revolutions per minute. All the engines were made by the Westinghouse Company, who have also 3 additional engines of the larger size on

1. *Journal of Gas Lighting.*

order for the station. The engines are of the vertical single-acting 3-cylinder type, working on the "Otto" principle. They are started by means of compressed air, which is stored in tall vertical tanks fixed against the wall of the engine room. The smaller generating sets are provided each with its own air compressor; but separate compressors, driven by electric motors, are also installed. The mode of starting is exceedingly simple. One of the cylinders of the engine is operated as a compressed air engine for the nonce, by turning a valve which cuts off the gas supply, and admits compressed air in its place. Provision is also made for shifting the cams which actuate the exhaust valves, so that the latter are allowed to open in the remaining cylinders during the compression stroke—thus relieving the pressure, and allowing the engine to gain speed smoothly. As soon as an explosion takes place in one of the cylinders, the compressed air is turned off and the exhaust valves are restored to their normal working cycle, and the engine runs up to full speed. The whole operation is very much more expeditious than the starting of a steam engine of equal power. Whereas the latter would have to be gradually warmed up before it could be thrown on the load—an operation occupying from 15 minutes to an hour or more—the gas engine can be started and fully loaded within 2 minutes, without fear of injury to the mechanism. The whole operation can, of course, be carried out by one man with ease. A flywheel is provided at each end of the crankshaft, to insure steady running; that at the back being provided with slots to enable the engine to be barred round by hand.

The working results obtained at Walthamstow show clearly the economical performance of the gas plant. Though the total output of the works in the year ending March, 1903, was only half a million units, the cost of coal per unit was only 0.42d.—a better record than could be shown for the same period by any of the Metropolitan municipal electricity works. Even Hackney, where the cost of fuel is 0.48d. per unit, with an output three times as great, did not equal this record; while Stepney, with about the same output as Hackney, showed a fuel cost of 0.65d. per unit. It is clear that there is every prospect that in a few years at the outside the total working costs at Walthamstow, as well as the fuel cost, will be the lowest in the neighborhood of London.

Trial of a Pierson Suction Gas Producer.

Engineering notes that in January last the *Société Technique de l'Industrie du Gaz en France* offered a prize of 5,000 francs for a gas producer working satisfactorily with gas coke. Messrs. J. and O. G. Pierson, of 47 Rue Lafayette, Paris, accordingly entered for trial one of their suction gas producers, of which a full description was given in the issue of November 20 last. The plant entered was not primarily intended for using coke, but, as the figures from the official report which we publish show, it gave, nevertheless, extremely good results. The plant in question had a combustion chamber measuring 600 millimeters (23.6 inches) in diameter, and was 1.60 meters (5.25 feet) high. The purifying plant consisted of a vertical cooling column and coke washer, and a purifier of 2 square meters in area. It was designed to supply gas to a Crossley gas engine rated at 35-brake horse power. The trials extended over 5 days. The fuel used was, during part of the time, a mixture of No. 0 Paris coke (pieces under 1 inch in diameter) and coke breeze, but for the most part the latter alone was used. During most of the period of the trial the engine was lightly loaded, generating but 18 to 20 brake horse power; but short runs at full power were also made. Samples of the gas were taken at frequent intervals, and these on analysis showed that the gas contained from 11 per cent. up to 15 per cent. of CO_2, traces up to 1 per cent. of O, and 15 per cent. to 16 per cent. of CO. Owing to an accident to the apparatus, it was impossible to determine the proportion of hydrogen. In spite of the range of variation in the proportion of CO_2, the calorific value of the gas proved very constant, ranging only between 1,092 and 1,179 calories per cubic meter, the mean being 1,125 calories per cubic meter (128 B.T.U. per cubic foot). When one fuel was kept to, it should be noted the range of variation was much lessened, four samples of gas made with the mixed coke and breeze assaying respectively 1,142, 1,148, 1,126, and 1,119 calories per cubic meter. The different fuels used showed on analysis the following figures:

Kind of fuel....	Laroche breeze.	Paris No. 0 coke.	Paris breeze.
Moisture.....	1.40 per cent.	1.17 per cent.	1.86 per cent.
Volatile matter.	3.05 "	4.88 "	3.40 "
Ash.....	10.06 "	14.06 "	15.59 "
Fixed carbon...	86.89 "	81.06 "	80.01 "

The producer ran well throughout the trial, but it was nos possible to measure the volume of gas produced; the actual amount of fuel burnt was, however, 16 to 20 kilogrammes (35 pounds to 41 pounds) per hour. There was a little trouble from scaffolding on one day, but this was put right at once by a single stroke of the poker introduced through one of the upper inspection holes. At the end of the trial the producer was opened up and some small masses of clinker were found, but these came away at the first blow af the poker. The gas mains were also opened out and proved in satisfactory condition. The engineers in charge of the trial finally report that the apparatus worked well throughout, and, from its state when opened at the end of the trial, could evidently have run for a long time before requiring to be cleaned, which was the more noteworthy in that some of the fuel used contained more than 15 per cent. of ash.

A Novel Method of Plumbing a Chimney During Construction.

By F. M. Goodhue, in *Engineering News.*

Engineers may possibly be interested in an account of a somewhat novel expedient used by the writer in plumbing a large chimney during construction, which was erected in the summer of 1902 at Lawrence, Mass. The chimney itself was of the ordinary construction, 179 feet high above the foundation, 18 feet in diameter at the base, with an 8-foot flue, and was erected for the new power plant of the Champion-International Paper Company. Dean & Main, of Boston, were the designers, and Geo. N. Cole, of Lawrence, the contractor. The method of plumbing was suggested to the writer by R. A. Hale, engineer of the Essex Company, as being practical and doing away with all lines, wires and allied contrivances.

After the chimney was started, a transit point was established at some distance from the base of the chimney, and a line run over the center point; in this line, near the base of the chimney, a stake was driven, the line being marked by a tack therein. Later this mark was replaced by one on a card fixed to the chimney itself. Another transit line nearly at right angles with the former was also established. As the chimney was built up, any deviation whatever from the perpendicular in any direction would be at once noted from either one or both of the two lines, and steps taken to correct it. This was rendered easier by the fact that a center pole was established on the workmen's staging (interior), around which swung a radial arm, upon which was marked the offset of each course of bricks, thus maintaining the exact circular shape of the chimney, and the pole, about 3 inches in diameter, was used for the sight from the transit. The procedure without the pole would be upon the same principle, an assistant erecting a plumb at the exact center of the chimney as then building. In this way the chimney was carried up, with no delay or bother to the workmen from ordinary plumbing.

To satisfy curiosity and check results, after the chimney was finished a heavy weight was swung in the center, and it was found by this means that the deviation was about $\frac{3}{4}$ inch.

It is evident the method lends itself to other construction, as, for instance, where masons carry up an important corner and some other check besides their ordinary spirit levels is required.

The Production of Petroleum in 1903.

By "W. L. C.," in *Iron Age.*

The great increase in the use of liquid fuel during the past year lends added interest to the annual report of the United States Geological Survey on the production of petroleum in 1903, which has just been completed by F. H. Oliphant. The production of the year reached the enormous total of 100,461,337 barrels, being larger than that of any previous year and greater than that of 1902 by 11,694,421 barrels, a gain of 13.17 per cent. as compared with a gain of 27.92 per cent. in 1902 over 1901. The greatest part of the increase during 1903 was from the State of California, which in 1903 produced 24.27 per cent., or nearly $\frac{1}{4}$ of the entire production. The increase in California in 1903 was 10,398,204 barrels. Next to California the largest gain in production was in Indiana, which was 1,705,515 barrels. Kansas showed a remarkable gain in production of 600,465 barrels, Kentucky and Louisiana showed gains of about 369,000 barrels each, Indian Territory gained 101,811 barrels and New York gained 43,248 barrels. On the other hand, there was a slight decrease of 128,086 barrels in Texas, and

Ohio, Pennsylvania and West Virginia all showed decreased production, amounting to a total of 1,852,619 barrels. The largest decrease in production in 1903 was in Pennsylvania, and amounted to 708,724 barrels.

The official statistics reveal the fact that in the last 6 years there has been a very remarkable change in the percentage of the local production. The Appalachian and the Lima (Ind.) fields, which for many years produced all but a very small percentage of the whole, in the year 1903 produced only 55.38 per cent. of the total, as compared with 93.99 per cent. in 1898. The Appalachian and the Lima (Ind.) fields have continued regularly for the last 10 years to produce about 55,000,000 barrels per year. California has increased its production since 1900 in the most remarkable manner, so that during 1903 it produced 127,921 more barrels of petroleum than did the States of Pennsylvania and West Virginia combined. Texas has also been a very important factor in bringing about the readjustment of the percentages of production.

When the total value of the production in 1903, which was $94,694,050, is compared with $71,178,910, the value in 1902, the former shows a gain of $23,515,140, or 33 per cent. The production of Ohio was valued at $26,234,521 in 1903, West Virginia at $20,516,532, Pennsylvania at $18,170,881, Indiana at $10,474,127, Texas at $7,517,479 and California, which produced the largest number of barrels of crude petroleum, was valued at only $7,399,349.

The average price of all the petroleum produced and marketed during 1903 was 94.26 cents per barrel, as compared with 80.19 cents per barrel in 1902, an increase of 14.07 cents per barrel, as compared with a decrease of 15.51 cents per barrel when the value received for the production of 1902 is compared with that of 1901. For the last 2 years the increasing quantity of cheaper petroleum produced has had its influence in reducing the average price per barrel of the entire production, notwithstanding that much higher prices were paid for Eastern petroleum in 1903 than in 1902.

The average price paid for Pennsylvania petroleum, which is about 95 per cent. of the entire production of the Appalachian field in 1903, was $1.59 per barrel, as compared with $1.23¼, the average price paid in 1902. There was also a gain of about 27 cents per barrel in the price paid for the production in the Lima (Ind.) field during 1903, over that of 1902. On the other hand, the average price of California petroleum decreased from 34.8 cents per barrel for the year 1902 to 30.3 cents for 1903. The price of the Texas petroleum showed a large advance in the average price paid, as the production of 1903 averaged 41.87 cents per barrel, as compared with 22.1 cents for that of 1902, a gain of 19.77 cents, or 89 per cent. The highest price quoted during the year was $7 per barrel for the lubricating petroleum produced in Wyoming.

The close of the year 1903 about completes the third year since the discovery of the remarkable deposit of petroleum at Spindle Top, Tex. by the large flowing well drilled by Captain Lucas. Since then, within a radius of 30 miles from Spindle Top, there has been produced, including loss by fire and fuel consumption, not less than 40,000,000 barrels of crude petroleum. A large quantity has also been absorbed by earthen reservoirs. Since 1896 there has been a considerable production of a remarkably pure crude petroleum at Corsicana, amounting to 401,817 barrels in 1903, but the wells are small, and there has been a gradual decline since its maximum of 829,560 barrels of production was reached in 1900. The rapid development of the Sour Lake pool, the increased production at Saratoga, the decline in the production of the original pool at Spindle Top and the opening of an entirely new pool, known as Batson's prairie, near the close of 1903, are among the important events in the industry of this State during the last year. The entire production of the State in 1903 was 17,955,572 barrels. In that year Texas ranked third in quantity of production. A very large proportion of the oil produced in Texas in 1903 was consumed either in that State or Louisiana and a large quantity of the oil was employed by the railroad companies as fuel for oil burning locomotives, one company having since 1901 equipped 212 locomotives with oil burners and tank tenders.

The most important event connected with the output of petroleum in the United States in 1903 was the remarkable increase in the production of California and its sudden elevation to head of the States producing petroleum, superseding Ohio, which for several years previous ranked first. When values are compared, however, California's rank is sixth, being slightly less than that of Texas. The total State production was 24,382,472 barrels in 1903. The greater portion of the increase came from Kern county, which, almost doubling its former large output, produced over 74 per cent. of the total. The successful introduction of petroleum fuel on the Pacific coast has caused a rapid decline in the importation of coal. The problem of cheap fuel has been solved. The railroads, the manufacturers and the steamship lines are being directly benefitted by its general introduction as an economical and perfect fuel.

The table presented below gives the number of barrels of petroleum equivalent to 1 ton of the coal usually found in the San Francisco markets, the cost of petroleum being estimated at $1 per barrel. If the cost is more or less than $1 per barrel the figures in the third and fourth columns can be changed proportionally. The third column gives the price that the purchaser can afford to pay for coal per ton to equal the fuel value of petroleum at $1 per barrel. The fourth column shows the reduction in cost of the fuel, due to the cheaper handling of petroleum.

One Pound of Combustible.	Pounds of Water Evaporated at 212° per Pound of Combustible.	Barrels of Petroleum Required to do the same Amount of Evaporation as Ton of Coal.	Cost of Coal per Ton to Equal Petroleum at $1 per Barrel.	Less 10 per cent. owing to the Greater Economy in Handling Petroleum.
Petroleum, 15° to 18° Baumé..	16.0	...	....	....
Cardiff lump, Wales....	10.0	4.0	$4.00	$3.60
Cape Breton, Canada.....	9.2	3.7	3.70	3.33
Nanaimo, British Columbia....	7.3	2.9	2.90	2.61
Co-operative, British Columbia.	8.9	3.6	3.60	3.24
Greta, Washington.....	7.6	3 0	3.00	2.70
Carbon Hill, Washington.....	7.6	3.0	3.00	2.70

The enormous recent increase in the production of petroleum in California is one of the marvels of the industry. Ten years ago the output was but 705,969 barrels, or only a fraction more than 2 per cent. of the production in 1903. Unlike the Texas field, the output in California has been very economically managed and the oil reserve appears to be well nigh inexhaustible.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. ROGER W. POLK has resigned from the service of the Rutland (Vt.) Company in order to accept a very responsible position with the Laclede Firebrick Manufacturing Company, of St. Louis, Mo. He assumes his new duties in about a fortnight.

MR. POLK'S successor at Rutland is Mr. W. H Lawson, who was Mr. Polk's assistant.

MR. A. M. SUTHERLAND, President of the Empire Gas Improvement and Construction Company, of New York, informs us that he believes the plant of the Pen Argyl (Pa.) Gas Company will be in actual operation by November 15th. He has also contracted to put in a complete new plant for the parties in control of the gas supply of Claremont, N. H. The generating and holder equipment are to be finished by December 1st, but the extensions to the street main system will not be made until next spring.

AT a recent meeting of the proprietors of the American Improvement Company, of Seattle, Wash., whose avowed intention is to supply gas in that city for 85 cents per 1,000 cubic feet; the following organization was perfected: President, W. D. Hofties; Vice-President, F. C. Harper; Secretary, Frederick B. Chandler. Gas at 85 cents per 1,000 in Seattle, it would seem to us, is not likely to attract the favorable attention of investors.

MR. WILLIAM S. HILLES, who recently purchased at receiver's sale the plant and franchises of the Oxy-Hydrogen Gas Company, which is a relic of Mr. J. E. Addicks's attempt to start an opposition plant in Wilmington, has formerly transferred the same to the Wilmington (Del.) Gas and Electric Company.

THE gas plant of the Albuquerque (New Mexico) Gas, Electric Light and Power Company, is being rebuilt.

JUDGE EDWARD G. BRADFORD, of the United States District Court, recently filed a finding in Trenton, N. J., denying the application for a preliminary injunction, made by the American Lighting Company against the Public Service Corporation and others, in the matter of public street lamps in Jersey City. In the opinion Judge Bradford quotes from the bill of complaint as follows:

"That the Public Service Corporation enjoys a complete monopoly of the manufacture and sale of gas for public use in the streets of Jersey

City; that there is no other source of supply from which the complainant can obtain gas for consumption at the lamp posts aforesaid; and if the defendants, or either of them, be allowed and permitted to shut off the supply of gas from the lamp posts and lamps, or in any way or by any method to discriminate against the complainant by refusing to supply gas for use in the lamps and their business, irreparable wrong and injury will be done to the complainant, as well as to the citizens and inhabitants of Jersey City."

In regard to this, the court refers to an opinion rendered by Vice-Chancellor Pitney in the suit between the same parties, and indorses the view expressed by him to the effect that the American Lighting Company has no standing whatever, in its own right, to demand a supply of gas from the Public Service Corporation. It is further pointed out by Judge Bradford that Jersey City was not joined in the suit as a complainant nor had that city intervened or applied for leave to intervene, and that to grant an injunction would be detrimental to the interest of the public. In denying the application for a temporary injunction Judge Bradford decreed that the costs abide the event of the suit.

MORE legal troubles, on account of the neglect of the owners of the Dover, Port Oram and Rockaway Gas Company, of Dover, N. J., to listen to the demands of the Collector of Taxes, are reported.

ANOTHER charter for the placing of a gas works in Oxford, Pa., has been issued by the State authorities. This time the applicants are appealing under the name of the Citizens Gas and Fuel Company. Personal mention of the proposers is not made. The concern is capitalized in $20,000.

MR. WILLIAM H. FULLAGER, Superintendent of the Coast Gas Company, Belmar, N. J., is suffering from injuries resulting from contact with a trolley car on the Spring Lake division of the Atlantic Coast Electric Railway, of New Jersey. The motormen on this line seem to have a firm belief that speed is the main thing for record making.

A CORRESPONDENT in Richmond, Va., writing under date of the 10th inst., says: "The Union Gas Company, of Richmond, was granted a charter by the State Corporation Commission last week. The applicants declared that their purpose was the 'generation, purchase and sale of all kinds of gas and electricity.' The officers named are: President, F. W. Dyer, New York city; Vice-President, Horace Sylvester, Brooklyn, N. Y.; Secretary and Treasurer, Walter S. Seabury; Directors, the above named and Messrs. W. R. Meredith and W. H. Sands."

THE new holder for the gas division of the Muskegon (Mich.) Traction and Lighting Company is in satisfactory service. The capacity of the vessel is 800,000 cubic feet.

THE authorities of the Village of Saratoga, N. Y., have awarded a contract for the public lighting of that place for a term of 4 years to the Saratoga Gas, Electric Light and Power Company. The present service comprises 125 arc electric, 137 incandescent electric and 227 ordinary gas lamps.

THE Worcester County (Mass.) Gas Company has virtually decided not to compete for the gas supply of Palmer, Mass.

THE Allentown (Pa.) Gas Company has issued a mortgage of $500,000 on its plant and franchises vesting in Allentown. The Trustee is the Provident Life and Trust Company, of Philadelphia.

A CORRESPONDENT in Worcester, Mass., writing under date of the 9th inst., says: "Mr. John S. Brown, who has resigned the position of Superintendent to the Clinton (Mass.) Gas Light Company, was some days ago presented with a watch fob and gold charm, in the form of a locket, from his former co-workers. The informal presentation took place in the office of the Company on Union street. John Whalen made a short speech, to which Mr. Brown responded, thanking all who contributed to the present. Early next week, Mr. Brown will leave Clinton for St. Louis, where he will take in the Exposition. He will then go to his home in Indianapolis. Fred. L. Fullam, successor of Mr. Brown, has taken charge and is becoming acquainted with the works and gas distributing system of Clinton."

MR. T. W. ALEXANDER, for some time connected with the office force of the Bay City (Mich.) Gas Company, has resigned therefrom.

AS was expected, the plant and franchises of the Oshkosh (Wis.) Electric Light and Power Company, which was recently purchased under foreclosure proceedings, have been formally turned over to Mr. Edgar F. Sawyer, representing the Oshkosh Gas Light Company.

THE proprietors of the Excelsior Coke and Gas Company, of Topeka, Kas., have given the authorities formal notice of their acceptance of the new franchise. Mr. Holliday and his associates will now go on with the work of putting the plant in shape for the better service of Topeka with gas for light, heat and power.

THE proposed gas plant for Nevada, Ia., seems an assured fact. At least so says Mr. W. H. Harrison, of Toledo, who is backing the project.

ARTICLES incorporating the Ramapo and Rockland Gas Company have been filed with the Secretary of State of New York. It is capitalized in $250,000, and it proposes to transact business in the towns of Ramapo, Clarkstown and Orangetown and the villages of Suffern and Spring Valley, Rockland county. The Directors are: D. W. Lafetra, Ridgewood, N. J.; P. V. H. Hewlett, S. H. Pennington, Newark, N. J.; Edgar Tilton, Suffern; M. T. Walsh, German Valley; Edward Oakes, Glen Ridge; S. H. M. Agers, East Orange; F. B. Palmer, Spring Valley, and Diedrich A. Heidgerd, Monsey.

THE following is from a recent issue of the Atlanta (Ga.) *Constitution*: "The city of Macon, Ga., would like to know just what the water works plant now in operation here, controlled by a board of directors in Philadelphia, can be bought for? At least President Powell, of the Macon Gas Light and Water Company, was yesterday sent a copy of a resolution passed by Council authorizing Mayor Smith to open negotiations for the purchase of the plant. The municipal ownership plan has been tried extensively by other cities and Macon would like to try her hand at it."

Electricity, in replying to the statement of "What is Wanted in Incandescent Electric Lamps," says: "Like everything else, time introduces changes in the character and application of old inventions. As an example, the steam engine is about to divide the field with a worthy competitor, the steam turbine, and in a similar manner many hybrid types of lamps have appeared on the market which were invented for the ostensible purpose, to use a hackneyed expression, 'of filling a long felt want.' What this want is, is to some a difficult thing to understand, yet in the light of modern science and present progress, a distinct necessity has arisen.

"A brief resume of the subject with regard to incandescent lamps, teaches us that these light producing devices can only succeed if their design and construction are based upon certain conclusions, which might be termed the light giving, and the efficiency giving principle.

"These ideas, which are fundamental with respect to this problem, are reduced to methods of comparison by referring to them as candle power and watts per candle. So the problem narrows itself down to a consideration of the amount of light a lamp produces and its cost in power per candle. How to obtain plenty of light from little power, without involving a great expense and trouble in the production of the light producing device, is the thing required.

"How do we stand at present in this respect? This question might be answered by saying that while progress has been made in the cheapness of construction of incandescent lamps, which of necessity has been a great aid to electric light companies, and the public at large, the improvement in the lamp itself as regards efficiency stands about the same. Comparative perfection has been reached in the generators, in the system of lighting of which they are an indispensable part, and in the plan of wiring through which the current is economically transmitted and distributed, but when we come to the lamp, there we meet with a standstill. The lamp taking 3 watts per candle still dominates the field, and all the efforts of the inventors of vacuum tube systems and mercury vapor systems and lamps with rare oxide filaments, these, we are sorry to say, while they represent interesting departures, are more experimental than successful, more scientific than practical, and for that reason there is still a want, a demand, if it may be so called, for a lamp to give more light that takes less power—a lamp which represents a distinct economic departure in both principle and construction."

THE authorities of Seattle, Wash., are advocating the passage of an ordinance creating the office of inspector of gas and gas meters.

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NOTIFICATION RESPECTING ADVERTISING.
Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:
New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, OCTOBER 17, 1904.

The Market for Gas Securities.

The market for city gas shares was animated and the trading was done at better prices than prevailed last week. Many sales were recorded and much of the buying was traced to houses that distinctly represent investment purchasing. The idea gains ground in well-advised quarters that the final taking over of the Consolidated Gas Company by its successor is not far off. If the transfer takes place within a year Consolidated should now be selling at 250, instead of 212 to 212½, which were the closing quotations, Friday, the 14th.

Brooklyn Union keeps dull and strong, with few actual transfers. It is nominally 220 to 224. Baltimore Consolidated is 81 to 82, and at those figures it looks to us a purchase. Peoples, of Chicago, is 106⅞ to 107, and Washington (D. C.) is at the reeord price of 303 to 305. Cincinnati Gas and Electric is 107 bid. Laclede preferred is inquired for at 81 to 83, and better figures in the near future are predicted for it.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

OCTOBER 17.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	212	212½
Central Union, Bonds, 5's	3,000,000	1,000	106¼	106½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	270	300
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	108¼	108¾
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	.
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	..	..
Northern Union, Bonds, 5's	1,250,000	1,000	104½	106½
New York and East River.. Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000	..	106	108
Standard	5,000,000	100	125	130
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	220	224
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	—	—
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	83	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4	4¼
" " Bonds, 5's	5,250,000	1,000	123¼	.
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,850,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	107	107½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	97¼	99
Columbus (O.) Gas Lt. & Heating Co	1,682,780	100	88¾	89¼
Preferred	3,026,500	100	107⅞	109
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	81	82
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	89½	92
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	75	75¼
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	199	200
Hudson County Gas Co., of New Jersey	10,500,000	..	88	92
" Bonds, 5's	10,500,000	..	105¼	106
Indianapolis	2,000,000	..	65	68
" Bonds, 6's	2,650,000	..	107	109
Jackson Gas Co	250,000	50	82	.
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	..
Preferred	2,500,000	100	81	100
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¼
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¼
New Haven	1,000,000	25	64	70
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	106⅞	107
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	94	96
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047 000	1,000	94	96
Washington, D. C	2,600,000	20	303½	304½
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	230	..

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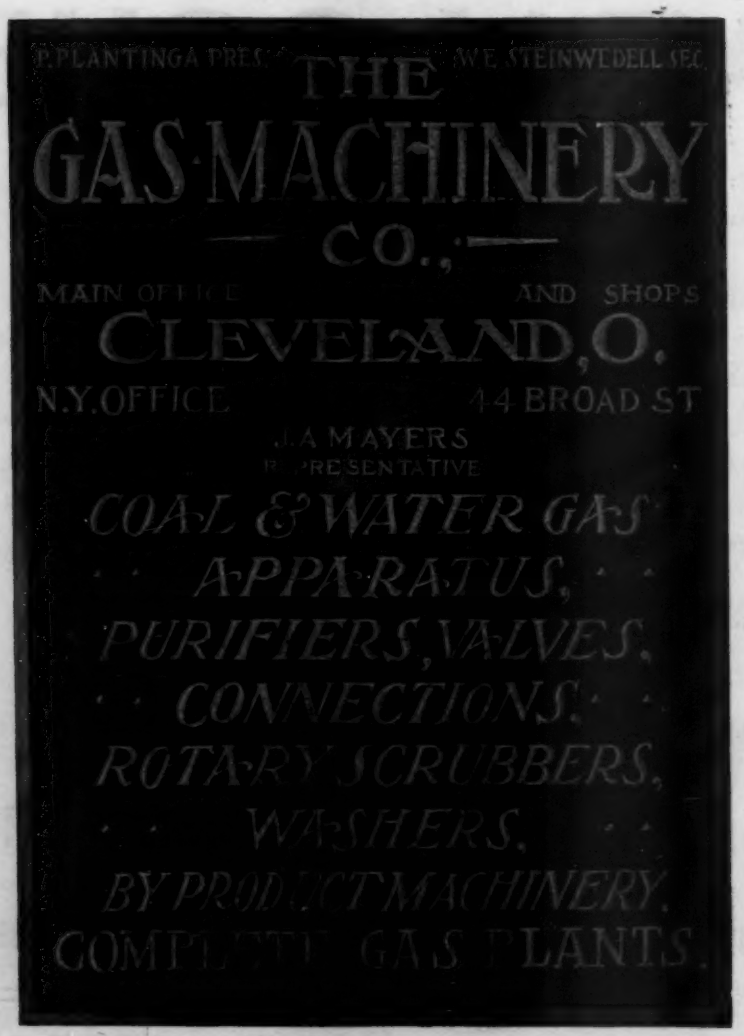

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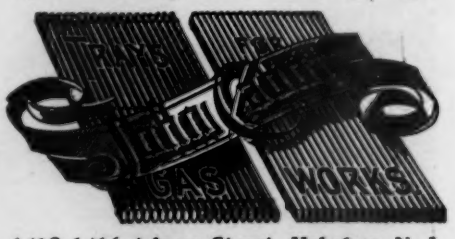

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Diameter, 12 "
Shipping weight, 80 lbs.
Net weight, 70 lbs.
The products of combustion are entirely separate from the water. Entire water surfaces are tinned.

Price, $35.00.

HOT WATER

FOR BATHROOM AND KITCHEN

is most easily, quickly and economically supplied by a

Humphrey Crescent Instantaneous Water Heater.

Prices range from $20 to $45.
Every Heater GUARANTEED.

Set a heater for every gas consumer. You will please them and increase sale of gas at the same time.

Send to-day for catalogue and discounts to

HUMPHREY CO.,

Kalamazoo, Mich.,

The only manufacturers in the World of a COMPLETE LINE OF INSTANTANEOUS WATER HEATERS.

Gas Analyses of All Sorts and Conditions,

—OR—

Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,

1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.

FRED. BREDEL COMPANY,

ENGINEERS AND BUILDERS OF GAS PLANTS.

Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.

Special High Grade Material for Recuperative Furnaces.

Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS.

BRAY BURNERS

Are Used Everywhere,

Because they are the best.
Reliable absolutely.
Accurately marked.
You can't find a city in the world,
with gas, not using them.

All Bray Burners are stamped with Name and Trade Mark.
Refuse Imitations. Send for Blue Book.

WILLIAM M. CRANE COMPANY,

1131 & 1133 Broadway, New York City.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

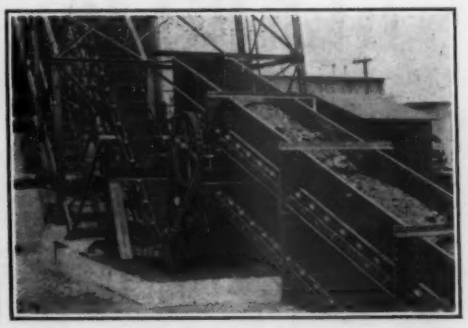
Double and Single Gate Valves, ¼" to 72".

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



COAL-CRUSHING, ELEVATING AND CONVEYING MACHINERY,

Installed 1903 for Empire Coke Co., Geneva, N. Y.

Machinery consists of steel track hopper, 25' centers overlapping pan apron feeder, 3-roll coal crusher and 112' centers continuous bucket inclined elevator. The machinery handles run-of-mine bituminous coal at rate of 45 tons per hour.

Link-Belt circulars (descriptive of many types of coal-handling methods) free on request of interested persons.

LINK-BELT ENGINEERING CO.,
Philadelphia.

NEW YORK: 49 Dey St. PITTSBURG: Park Bldg.
CHICAGO: Link-Belt Machinery Co.

Grand Rapids, Mich., Oct. 17, '04.

Mr. Gas Company:

You can get back some of the business that goes to your electric friends if you furnish the Qui-Vive Flasher for gas lights, in signs or elsewhere.

Respectfully,
THE QUI-VIVE CO.

153 Canal Street.

FIELD'S ANALYSIS FOR THE YEAR 1903.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 35th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by

A. M. CALLENDER & CO., 42 Pine St., New York City.

J. F. W. JOST,

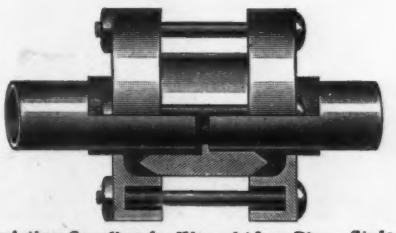
CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,

P. O. BOX 2043, PHILADELPHIA, PA.

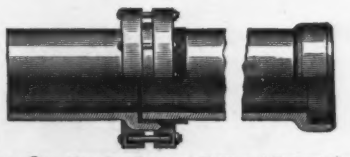
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

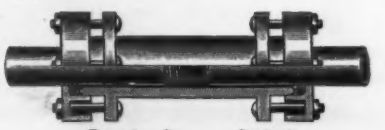
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



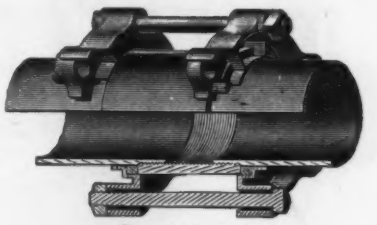
Insulating Coupling for Wrought Iron Pipe. Style 5.



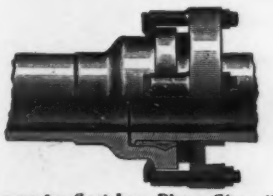
Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

ARE YOU MARRIED to any other burner?

If not, please give us an opportunity to get your orders. Tell us what your pressure is and we will send you samples which we know will please you. Steward Burners are made for 8-10, 12-10, 15-10, 20-10, 25-10 or 30-10 pressure, and in sizes from 2-foot to 8-foot.

D. M. STEWARD MFG. CO., Est. 1876, CHATTANOOGA, TENN.

LLOYD CONSTRUCTION COMPANY,
DETROIT, MICH.

GAS WORKS BUILDERS.

MUELLER PIPE END REAMER.

RATCHET HANDLE PATTERN.

C-035.

If the blades of a pipe reamer are tapered too long they will cut further into the pipe than is necessary to remove the burrs, and require unnecessary labor from the operator.

Mueller Pipe Reamers have the blades so tapered that they cut into the pipe only far enough to remove the burrs. They perform only the necessary amount of work with the least possible labor.

Mueller Pipe Reamers will ream any size of pipe, from ¾ to 3-inch. They are made in plain handle and ratchet handle patterns. The reamer illustrated is the ratchet handle pattern.

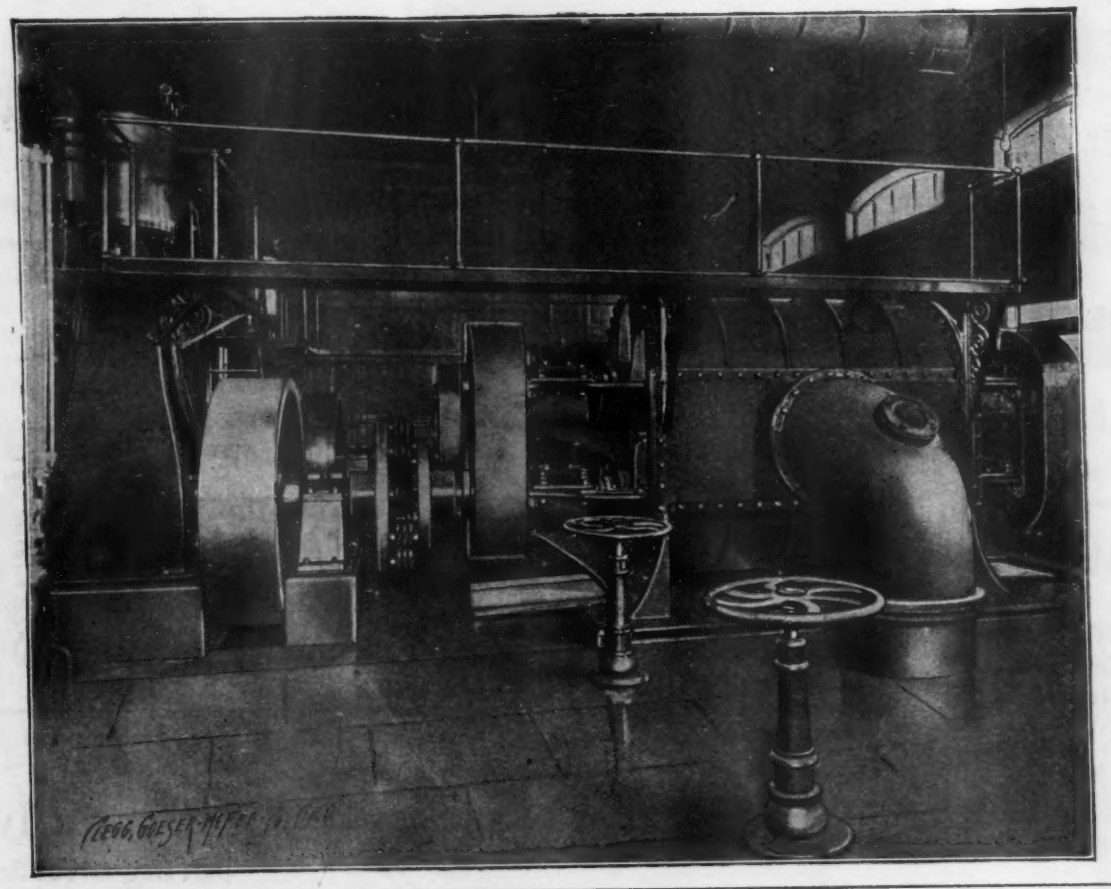
Each reamer is carefully inspected and assembled, is given a working test as near like actual service use as possible, bears the Mueller trade mark, and is *unconditionally guaranteed.*

We also make tapping machines, meter connections and a full line of ground key work for gas works' use.

Mueller Pipe End Reamers are on exhibit in the Palace of Manufactures, World's Fair.

H. MUELLER MFG. CO.,
DECATUR, ILL., U. S. A.

ROOTS' GAS EXHAUSTERS.



Installation showing our latest improved machines, with flexible rope coupling, for large units.

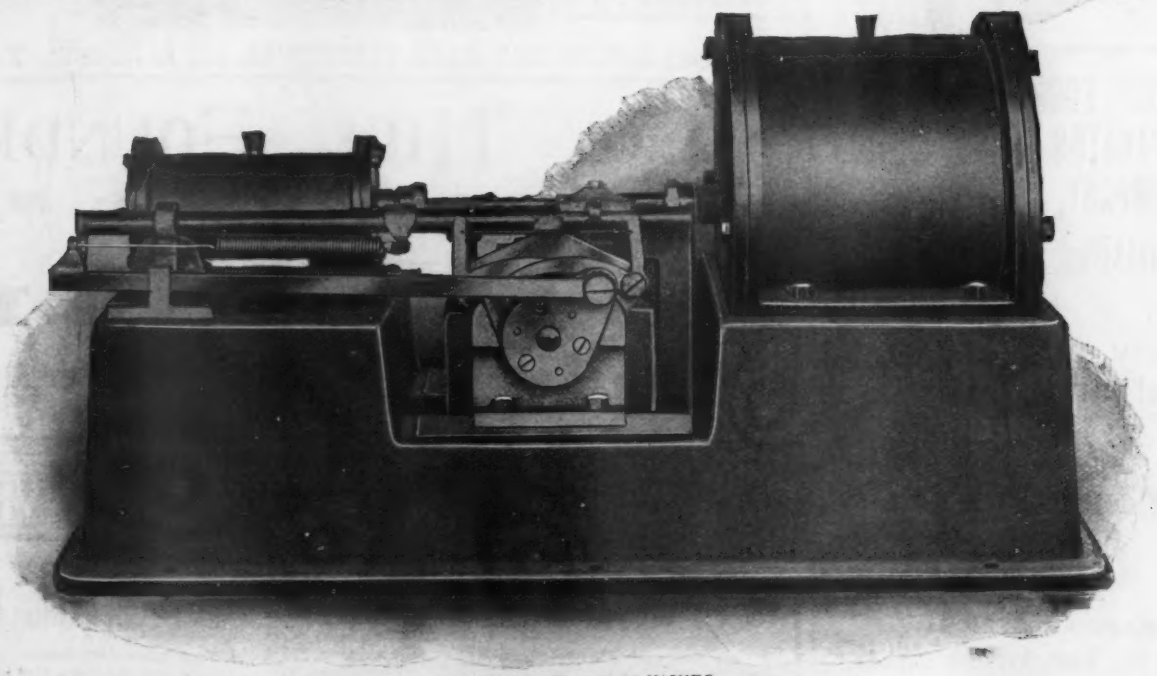
SEND FOR CATALOGUE.

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Building.

COMPTON GAS PRESSURE BOOSTER.



FLOOR SPACE, 9 X 23 INCHES.

An automatic gas booster that increases the lighting power of mantle burners over 500 per cent. Obviates the necessity and expense of high pressure gas mains. Booklet, telling all about it, for the asking, mailed free.

AMERICAN HYDRAULIC MOTOR COMPANY,

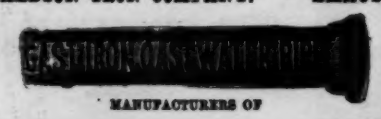
116 NASSAU STREET, NEW YORK

M. J. DRUMMOND & CO.
MANUFACTURERS OF
CAST IRON
FLANGE
GAS AND WATER PIPE

GENERAL SALES OFFICE:
182 BROADWAY, - - - NEW YORK.

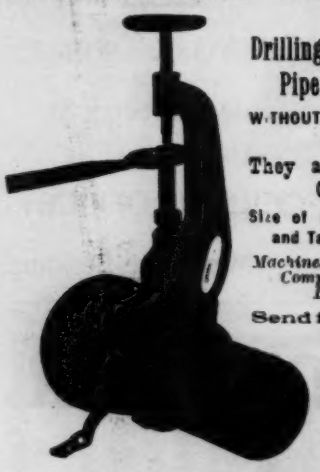
GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA.



MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.
Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES
—FOR—
Drilling and Tapping Pipe under Pressure
WITHOUT ANY ESCAPE OF GAS.
They are Strong and Compact.
Size of Combination Drills and Taps ¾ to 4-inch.
Machines Sent to any Gas Company for Thirty Days' Trial.
Send for Circulars.



Geo. Light,
DAYTON, O.

THE ECONOMICAL
GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,
Consulting Engineers.
Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::
PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,
Established 1856. Works at Phillipsburgh, N. J.
New York Office, 160 Broadway.

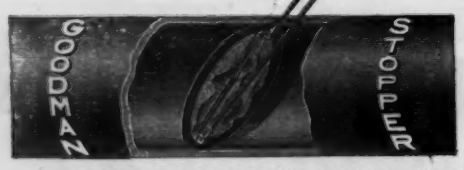
CAST IRON WATER AND GAS PIPE,
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF
Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

NO LEAKY JOINTS IN UNIVERSAL PIPE.

Specially adaptable for—
High and Low Pressure Gas Mains.
High and Low Pressure Water Mains.
WRITE FOR PRICES.
CENTRAL FOUNDRY COMPANY - - - 116 Nassau Street, New York City.

CHARLES MILLAR & SON CO., Selling Agents, Utica, N.Y.
Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.
UTICA PIPE FOUNDRY CO.
Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.
CAST IRON PIPE and SPECIALS FOR WATER AND GAS
Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

SAFETY GAS MAIN STOPPER COMPANY,
For Shutting Off Gas in Mains
Temporarily during alterations and repairs. : : : :
Any size gas main can be shut off in 30 seconds. : : :



STOPPERS SENT ON TRIAL.
Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

FOX HILL FOUNDRY,
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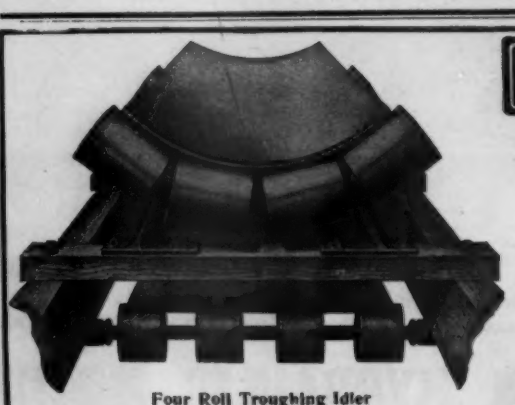
FINE OPENING
GRATE BARS
FOR GAS WORKS.
STATIONARY, SHAKING, DUMPING.
BARS FOR HAZELTON BOILERS.



Four Roll Troughing Idler
FOR WIDE BELTS.
The positions of the rolls conform to a natural and uniform curve of the belt.

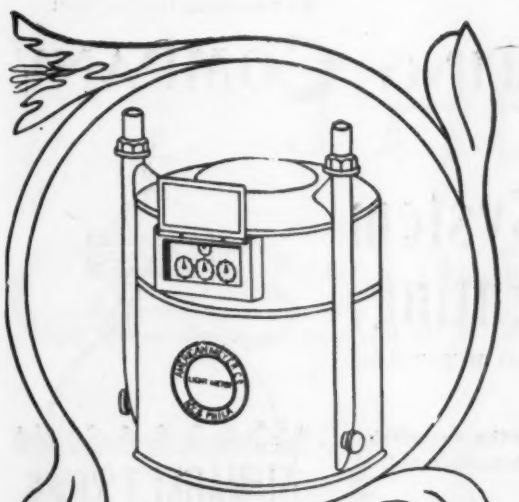
BELT CONVEYORS
EQUIPPED WITH
BALL BEARING ROLLS
Possess greater efficiency, consume less power, and the belts last much longer than when any other type of roll is employed.
Permit us to tell you why and to submit plans and estimates.
The Link-Belt Machinery Co.
Philadelphia Chicago U.S.A.

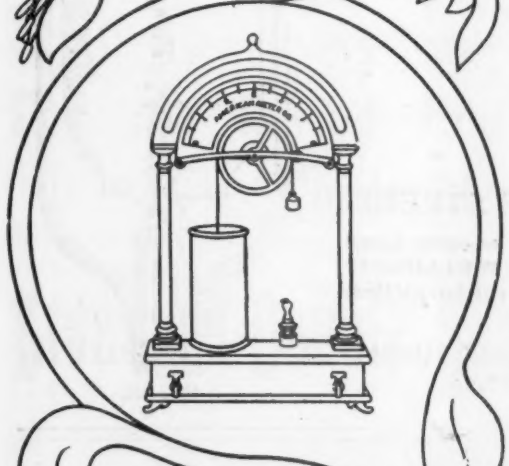
(Copyrighted, 1894, by the AMERICAN METER CO.)

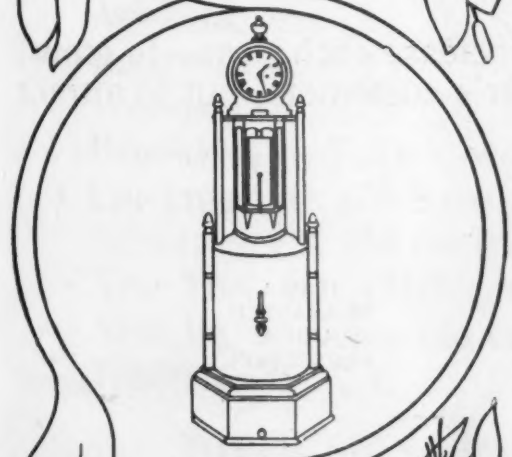
AMERICAN METER CO.

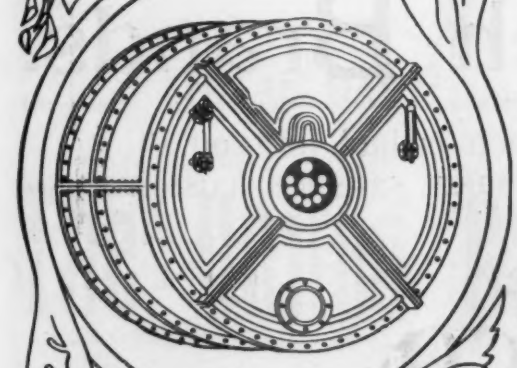
ESTABLISHED 1836. INCORPORATED 1863.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST. LOUIS,
SAN FRANCISCO.









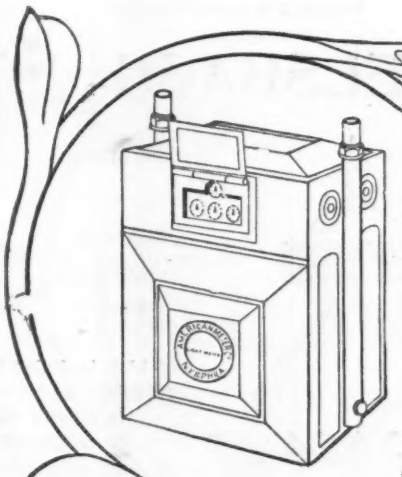
PUBLIC LIGHTING TABLE.

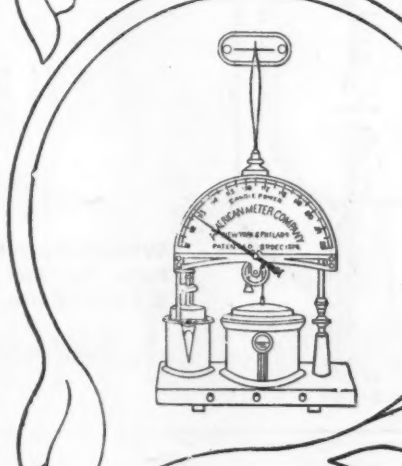
NOVEMBER, 1904.

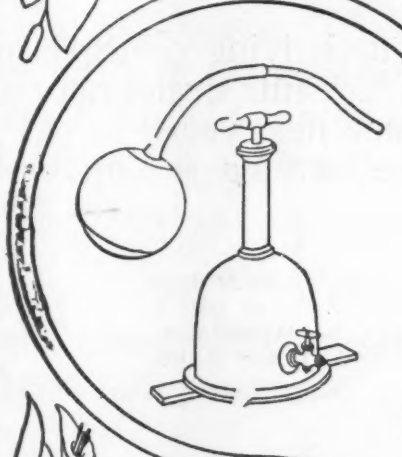
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	5.30 PM	1.30 AM	4.45	5.35
Wed.	2	5.30	2.30	4.45	5.35
Thu.	3	5.30	3.40	4.45	5.35
Fri.	4	5.30	5.30	4.45	5.35
Sat.	5	5.30	5.30	4.40	5.45
Sun.	6	5.20	5.40	4.40	5.45
Mon.	7	5.20 NM	5.40	4.40	5.45
Tue.	8	5.20	5.40	4.40	5.45
Wed.	9	5.20	5.40	4.40	5.45
Thu.	10	5.20	5.40	4.40	5.45
Fri.	11	5.20	5.40	4.40	5.45
Sat.	12	8.30	5.40	4.30	6.00
Sun.	13	9.30	5.50	4.30	6.00
Mon.	14	10.30 FQ	5.50	4.30	6.00
Tue.	15	11.20	5.50	4.30	6.00
Wed.	16	12.20 AM	5.50	4.30	6.00
Thu.	17	1.10	5.50	4.30	6.00
Fri.	18	2.10	5.50	4.30	6.00
Sat.	19	3.10	5.50	4.25	6.00
Sun.	20	4.10	5.50	4.25	6.00
Mon.	21	No L.	No L.	4.25	6.00
Tue.	22	No L. PM	No L.	4.25	6.00
Wed.	23	No L.	No L.	4.25	6.00
Thu.	24	5.10 PM	7.20 PM	4.25	6.00
Fri.	25	5.10	8.10	4.25	6.00
Sat.	26	5.10	9.10	4.20	6.10
Sun.	27	5.10	10.10	4.20	6.10
Mon.	28	5.10	11.20	4.20	6.10
Tue.	29	5.10 LQ	12.20 AM	4.20	6.10
Wed.	30	5.10	1.30	4.20	6.10

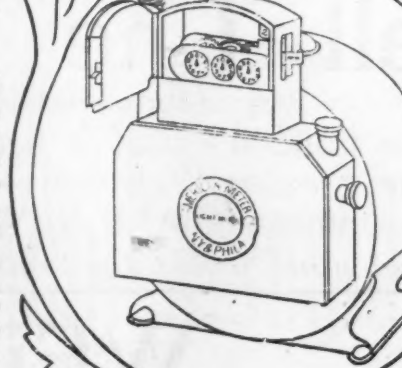
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00





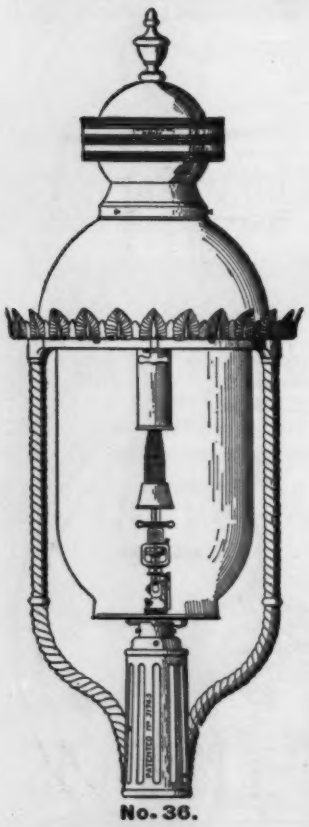




NEW YORK, 97 Liberty Street. BOSTON. 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Period Ending July 31st, 1904, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Augusta, Me.
Bangor, Pa.
Woonsocket, R. I. (2d contract).
Brooklyn, N. Y. (4th contract).
Cincinnati, O. (2d contract).
Scranton, Pa. (3d contract).
New York City (14th contract).
New Haven Conn. (2d contract).
Watertown, N. Y.
Tampa, Fla. (3d contract).
Westchester, N. Y. (3d contract).
Bridgeport, Conn. (2d contract).
St. Paul, Minn. (2d contract).
Harrisburg, Pa.
Pelham, N. Y.
Reading, Pa.
Springfield, Mass. (2d contract).
Lynn, Mass. (5th contract).

TOTAL SETS, 1904, ... 35
TOTAL DAILY CAPACITY, 1904, . . 50,400,000 cubic feet.
TOTAL SETS TO DATE, ... 543
TOTAL DAILY CAPACITY, ... 413,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

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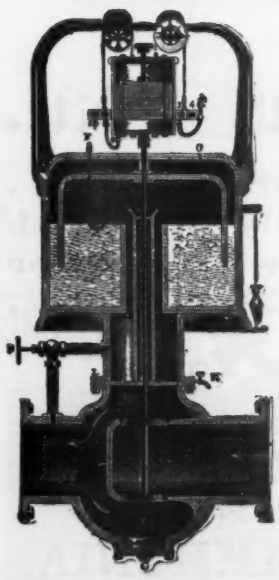

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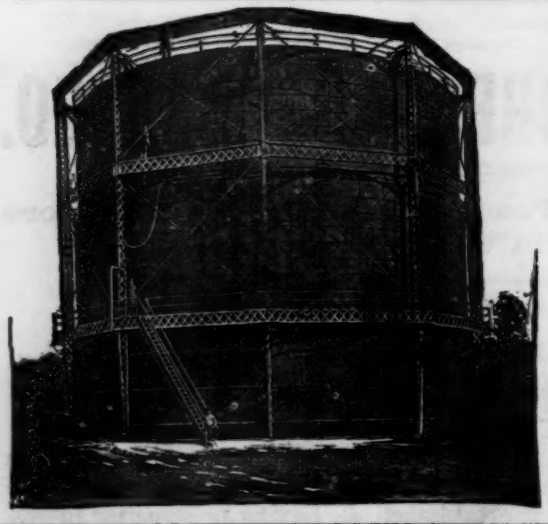

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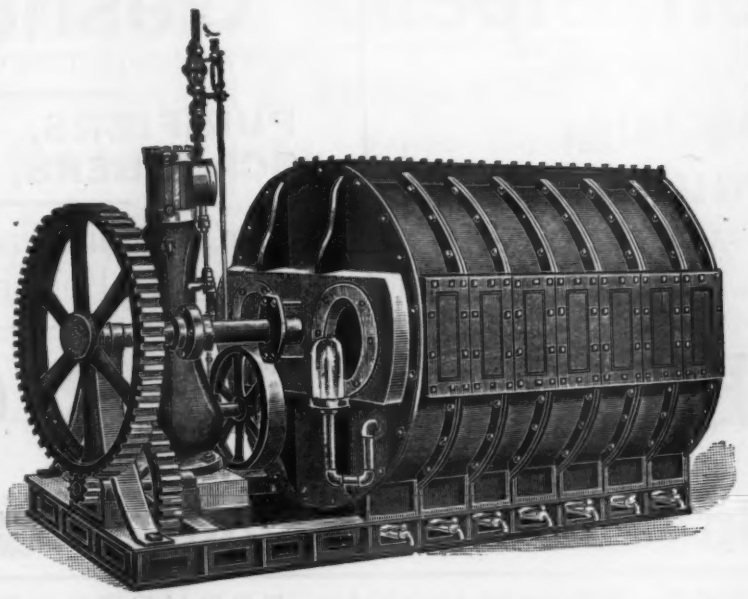

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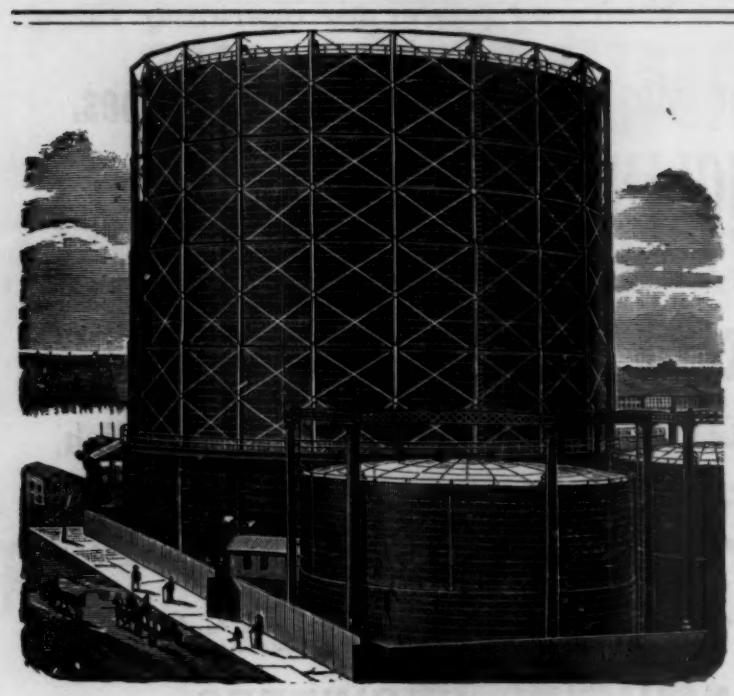

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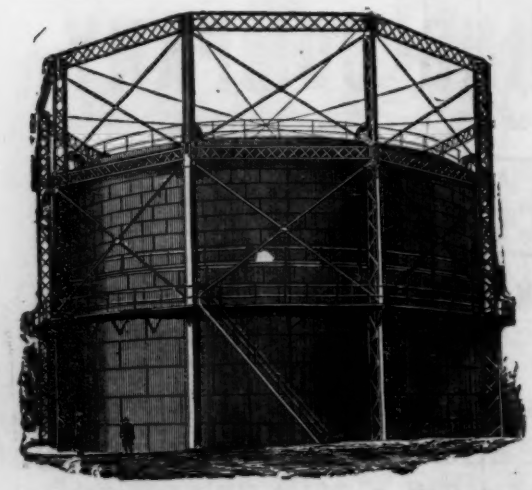

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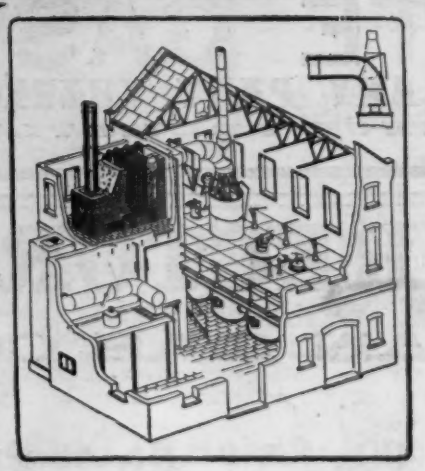

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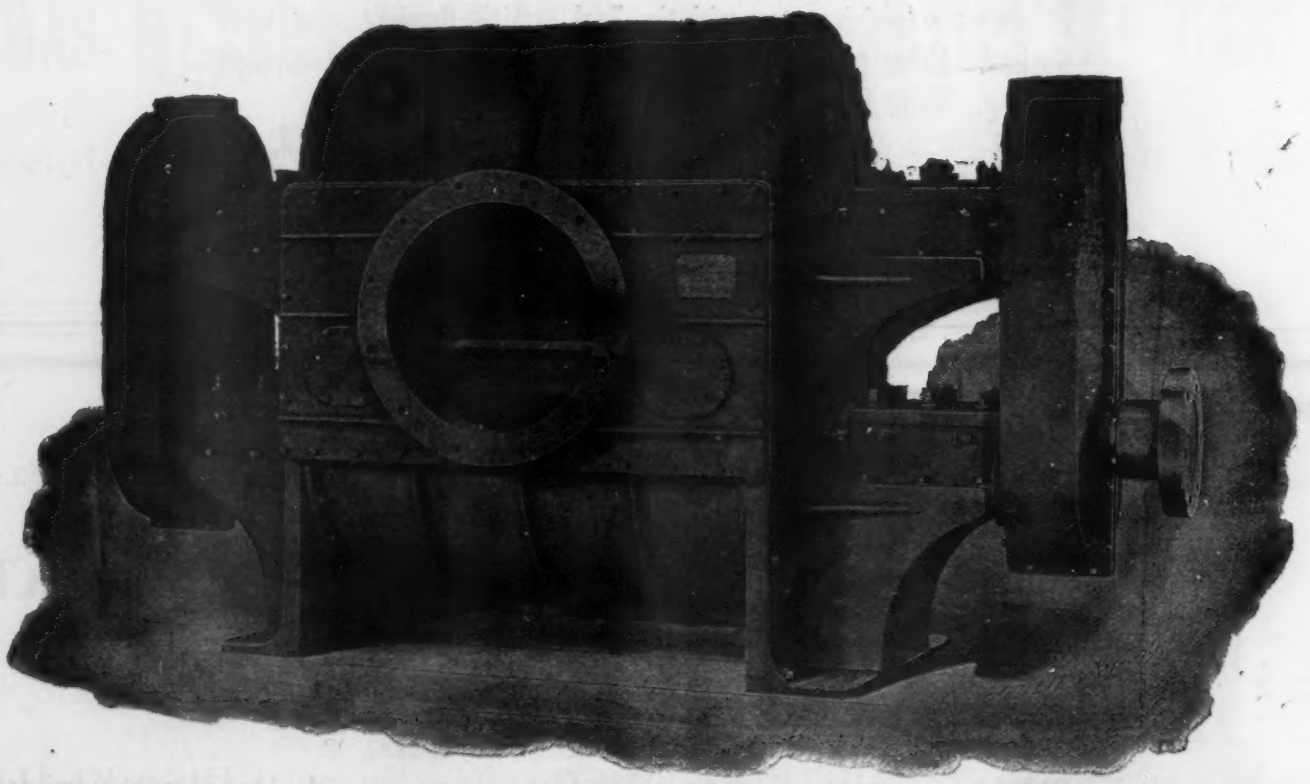

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